

# Essays on Agency in International Finance

by

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For Bratati, Dibyen, and Sushil

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## PREFACE

Economic agents often operate in environments with market imperfections and agency frictions. For instance, firms are controlled by managers and owned by atomistic investors, distorting incentives and resource allocation when corporate governance is weak. Or businesses participating in the market for corporate control face asymmetric information or search and matching costs. The effects of these frictions are often amplified or mitigated by the quality of economic institutions in a country. The purpose of this dissertation is to investigate the precise channels through which the interaction of institutional quality and market frictions influence macroeconomic variables such as output, investment, and asset ownership.

In the first chapter, I explore the relationship between the long-standing equity home bias puzzle and the quality of economic institutions. I document a novel stylized fact about home bias: countries with weaker institutions also hold fewer foreign assets. I then build an international asset pricing model that has a counter-intuitive implication: outside investors who reside in countries with weaker institutions find it optimal to hold more of their own country's assets. I go on to show that this is because domestic assets provide a better hedge against their labor income risk in countries with weak institutions when there are agency problems within firms.

The second chapter, based on joint work with Linda Tesar and Ron Alquist, looks at foreign direct investment (FDI) in the form of mergers and acquisitions during the 1997-1998 Asian Financial Crisis. Using both parametric and non-parametric survival-analysis techniques, we find that the survival-times of foreign acquisitions

in crisis-hit countries, versus countries less affected by the crisis, were shorter than domestic ones, and that pairings between firms from different sectors, and acquisitions by foreign financial firms were less likely to last if conducted during the crisis. By way of a simple model of matching between acquiring and target firms, we argue that this happens due to the reduced quality of the match between acquiring and target firms during financial crises.

The final chapter of this dissertation establishes a set of stylized facts about the relationship between institutional quality, macroeconomic volatility, the distribution of firm sizes, and financial development in a large cross-section of countries.

The interaction of economic systems with domestic institutions of varying quality is a key characteristic of the international economy today. Though most market-based economic activity occurs in a handful of countries with similar, well-developed capital markets, nations where institutional quality is relatively weak are playing an increasingly important role in international business cycles and capital movements. Thus, understanding how agency problems and institutions affect macroeconomic aggregates, portfolio investment, and FDI constitutes an important set of open questions that this dissertation addresses.

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## LIST OF ABBREVIATIONS

**DSGE** dynamic stochastic general equilibrium

**FDI** foreign direct investment

**MA** mergers and acquisitions

**GDP** gross domestic product

**SIC** Standard Industrial Classification

**FTSE** Financial Times Stock Exchange

**FSD** firm size distribution

**CEE** Central and East Europe

**USD** US dollars

**OLS** ordinary least squares

## ABSTRACT

Firms and investors often operate in environments with market imperfections and agency frictions. It is common wisdom that the effects of these microeconomic frictions are amplified or mitigated by the quality of economic institutions in a country. Yet little is known about the precise channels through which institutions influence macroeconomic outcomes. The first chapter of this dissertation documents a novel stylized fact: countries with weaker institutions hold fewer foreign assets. It then highlights a new mechanism, the hedging of labor income risk in the presence of agency problems, by which weak institutional quality affects the composition of country asset portfolios. The second chapter looks at FDI in the form of mergers and acquisitions (MA) during the Asian Financial Crisis of 1997-98. We find evidence that crisis-time MA between foreign acquiring firms and domestic targets were of lower longevity in crisis-affected countries. Using a simple model of matching between acquiring and target firms, we then argue that this was due to reduced match quality during the crisis. The third chapter establishes a set of stylized facts about the relationship between institutional quality, macroeconomic volatility, firm size distribution, and financial development in a large cross-section of countries.

## CHAPTER I

# Country Portfolios with Imperfect Corporate Governance

### 1.1 Introduction

Equity home bias is one of the most enduring puzzles in international finance. This paper uncovers a novel stylized fact about home bias: countries with lower institutional quality (“the South”) also hold fewer foreign assets.<sup>1</sup> This appears counter-intuitive. Why would countries with *worse* domestic institutions be *more* home-biased in their equity holdings, while having apparently better alternatives in countries with better institutions (“the North”)? The central contribution of this paper is to show that this striking pattern might actually be an equilibrium outcome of agency problems in the South.

To better understand the crucial role of agency problems, I start with the observation that the shares of a firm are typically held by two different kinds of agents, outsiders and insiders. An outsider is an investor who owns stock in a firm but has no direct control over its operations. A large part of her income comes from supplying labor. In short, she fits the description of the classical atomistic agent in a business

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<sup>1</sup>Institutional quality, measured by the indices from Kaufmann et al. (2008), refers to aspects of the economic environment such as the standard of general governance, the strength of contract enforcement, or the efficiency of the judicial system.

cycle model. By contrast, an insider is a large shareholder who has control over the investment, dividend, and employment policies of a firm by virtue of her sizeable equity stake. Weaker institutions lower the ability of outsiders to hold insiders accountable for their decisions through the usual mechanisms of corporate governance. I label this “imperfect corporate governance.”

With this structure in mind, I develop a two-country dynamic stochastic general equilibrium (DSGE) model of international portfolio choice with two distinct agents in each country – an outsider and an insider. I incorporate the conflict of interest that arises between these two parties when the latter has full control of the firm, yet owns only a part of it. Weaker institutions, by opening up opportunities for self-interested behavior by insiders, affect the payoffs of claims to the firm’s dividends. This influences the portfolio choice of both outsiders and insiders, yielding two main results. First, I find that for a given size of the float portfolio,<sup>2</sup> domestic *outsiders* will exhibit greater home bias in asset holdings in countries with weaker institutions. Second, in addition to this, worse institutions will make the domestic *float portfolio* itself smaller. The aggregate home bias in each country will then be the sum of these two elements.

The first result, that Southern outsiders are more home biased for a given float portfolio, follows from the impact of imperfect corporate governance on the ability of domestic assets to hedge labor income risk. The hedging properties of domestic assets have been examined as a possible explanation of home bias by Cole and Obstfeld (1991), Baxter and Jermann (1997), van Wincoop and Warnock (2006), Coeurdacier and Gourinchas (2008), Heathcote and Perri (2009), and Coeurdacier et al. (2009), among others. Building especially on the last two, I show that imperfect corporate governance makes domestic assets a better hedge against labor income risk in countries with worse institutions. The mechanism, working primarily through the

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<sup>2</sup>The float portfolio is a term used to describe the fraction of the Southern market portfolio actually traded in world equity markets, that is, the part not held by insiders.

dynamics of investment, plays itself out as follows. Consider the case of the South while holding the level of insider ownership constant. Insiders here can extract rents from firms as private benefits of control. Since more rents can be extracted from larger firms, they become “empire-builders.”<sup>3</sup> Empire-building affects the dynamics of investment in the following way. With a persistent productivity process, insiders anticipate a favorable shock to last for several periods. Hence, they find it privately optimal to reduce dividends below the first-best level to finance socially suboptimal capital investments in expectation of higher future private benefits. At the same time, a good productivity shock tends to increase labor income in the South, relative to the North, for two reasons. First, there is equilibrium over-employment in the Southern representative firm, resulting from higher investment. Second, the sharper increase in demand for domestic investment buffers the decline in South’s terms of trade that follows a favorable supply shock. This contributes to an increase in the relative value of Southern labor income. Thus, imperfect corporate governance amplifies the negative correlation between dividends on the domestic asset and labor earnings in the South. Consequently, home bias for domestic *outside investors* is greater in the South, due to their increased demand for domestic shares for the purpose of hedging their labor income risk. In general equilibrium, this also leads to lower Northern ownership of the Southern float portfolio.

The second result, that the South also has greater *insider* ownership of firms, and hence, a smaller float portfolio, works through a channel that has been studied by Admati et al. (1994) and DeMarzo and Urošević (2006).<sup>4</sup> As noted earlier, weaker institutions in the South let domestic insiders extract private benefits of control. Lower insider equity, by reducing the insider’s ownership of cash-flow rights of the

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<sup>3</sup>This is a version of the free-cash flow problem first pointed out by Jensen (1986). Private benefits of control could vary from outright pilferage of firm assets, to more subtle forms like product discounts to subsidiaries and share sales at low prices to related parties. See Nenova (2003), Dyck and Zingales (2006), and Albuquerque and Schroth (2009) for empirical estimates of private benefits.

<sup>4</sup>These papers study the asset pricing problem of a large shareholder in a partial equilibrium environment.

firm, increases extraction. Thus, risk-averse Southern insiders, wishing to diversify country-specific risk by buying foreign assets, can only sell their stake at a discount; outside investors, anticipating greater extraction, are only willing to trade shares with the insider at lower prices.<sup>5</sup> This acts as an endogenous “transaction tax” on the insider’s portfolio adjustments. The insider’s trade-off, between the potential benefits of diversification and the penalty of the transaction tax, determines the size of the float portfolio of a country. Since the effect of the transaction tax dominates in the Southern equilibrium, it ends up with more insider ownership. This outcome can be thought of as home bias on the part of insiders.

While insider ownership and the agency problems associated with private benefits of control have long been central to the finance literature (see LaPorta et al. (1998b, 1999, 2000a,b, 2002), Shleifer and Wolfenzon (2002), Nenova (2003), and Dyck and Zingales (2006)), these have not yet been incorporated into international macroeconomics.<sup>6</sup> To the best of my knowledge, this paper presents the first international real business cycle model with labor income and endogenous asset returns that characterizes outsider holdings and insider ownership in the presence of agency issues.

I show how poor institutions may amplify the effects of a well-known candidate explanation of home bias, non-diversifiable labor income risk. For this, I draw on insights from two lines of research. The first is the literature concerning the implications of agency problems on asset-pricing (Dow et al. (2005), Albuquerque and Wang (2006, 2008)) and macroeconomic aggregates (Danthine and Donaldson (2005), Philippon (2006)). My results address international portfolio allocation in the backdrop of this literature. The second is the recent work of Heathcote and Perri (2009) and Coeurdacier et al. (2009) that has focussed on the interaction of trade openness and labor income risk to explain the home bias puzzle. In contrast, I emphasize a different channel, institutional quality, through which labor income risk determines

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<sup>5</sup>The price corresponds to the lower post-trade level of insider ownership.

<sup>6</sup>Albuquerque and Wang (2006) is a notable exception.

home bias.<sup>7</sup> Thus, this paper brings together two areas in international macroeconomics and finance that have, surprisingly, remained separate until now.

In this context, one of the most important results of this paper is that imperfect corporate governance helps in resolving the asset home bias puzzle not only by limiting the size of the world float portfolio, but also by affecting its ownership pattern. Contrary to intuition, I find that domestic outside investors in countries with weaker institutions will hold more of their own country's float portfolio *because* it has weaker institutions. This paints a nuanced picture of the connection between insider ownership and home bias, a connection first described in Dahlquist et al. (2003) and Kho et al. (2006).

Building on the empirical research program of Faria et al. (2007) and Faria and Mauro (2009), this paper uncovers a new stylized fact about international asset holdings. It also contributes to the growing literature on the effects of institutions on economic outcomes such as financial development (LaPorta et al. (1997), LaPorta et al. (1998a)) by focusing on institutional heterogeneity in an international asset pricing framework. My work is also related to the extensive literature on financial integration and risk sharing in the presence of financial frictions, exemplified by the work of Kehoe and Perri (2002), Bekaert and Harvey (2003), Levchenko (2005), Kraay et al. (2005), Kalemli-Ozcan et al. (2008), Broner and Ventura (2008, 2009), Bai and Zhang (2008), Broner et al. (2008), and Kose et al. (2009), among others. The papers most closely related to my work are Heathcote and Perri (2009), Albuquerque and Wang (2006, 2008), and Coeurdacier et al. (2009). I discuss the connections between my results and theirs in more detail in a later section.

The rest of the paper is organized as follows. Section 1.2 establishes a new em-

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<sup>7</sup>Levy and Sarnat (1970), Tesar and Werner (1995), Lewis (1999), Warnock (2002), Lane and Milesi-Ferretti (2007), and Sørensen et al. (2007) have documented the asset home bias puzzle over the years. Some theoretical explanations of equity home bias in the finance and international macroeconomics literature are Cole and Obstfeld (1991), Uppal (1993), Stockman and Tesar (1995), Brennan and Cao (1997), Baxter and Jermann (1997), Baxter et al. (1998), Engel and Matsumoto (2006), Coeurdacier (2008), Heathcote and Perri (2009), and Nieuwerburgh and Veldkamp (2009).

pirical regularity about the cross section of country portfolios and reviews some that are well-known. Section 1.3 lays out a dynamic model of portfolio choice by outsider investors with exogenous insider ownership. Section 1.4 presents the main results of the paper and provides intuition for them. Section 1.5 discusses an extension with endogenous insider ownership. Section 1.6 concludes.

## 1.2 Stylized facts

This section makes two points. The first is that countries with weaker local institutions hold fewer foreign assets relative to their size. They also issue fewer foreign liabilities relative to their size, a fact that has been noted by Faria and Mauro (2009). The second is that, countries with weaker institutions have more insider ownership of their firms, first pointed out by LaPorta et al. (1999).

### 1.2.1 Data description

I look at the years 1996-2004 because that is the period of overlap of my two main sources of data: external wealth measures for the years 1970-2004 from Lane and Milesi-Ferretti (2007), and institutional quality indices for the years 1996-2007 from Kaufmann et al. (2008). The data sources are summarized in the appendix (A.1.1). Since the theoretical mechanism in the model is likely to be important only for those countries that make significant use of external financing for firms, I use the sample of LaPorta et al. (1999) with a few modifications.<sup>8</sup> The resultant group of 43 countries (21 developed markets, 22 emerging markets by the Financial Times Stock Exchange (FTSE) classification) retains significant heterogeneity in institutional quality.

I focus on portfolio and foreign direct investment as these financial claims have

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<sup>8</sup>Specifically, I include countries that had at least 5 domestic non-financial publicly traded firms with no government ownership in 1993. I exclude Luxembourg, Ireland and Switzerland from the analysis because their gross external positions are unusually large in relation to their GDP due to their status as financial centers. The countries are listed in the appendix.

explicit equity attached to them, unlike debt. I construct two measures of diversification using the gross equity (portfolio and foreign direct investment) assets and liabilities held by a country's nationals, deflated by the size of a country's economy measured by its gross domestic product. I take the simple average of these measures over the year 1996-2004 to get the cross-section of holdings. My measure of the quality of institutions is the simple average of the six indices in Kaufmann et al. (2008) that quantify general governance, the degree of corruption, the rule of law, political stability, effectiveness of regulations, and the strength of media and public opinion. The index so constructed ranges from -1.21 to 1.78 in my sample, with higher scores assigned to countries with better institutional quality.<sup>9</sup>

### 1.2.2 Two stylized facts

**Stylized fact 1.** *Better institutional quality in a country is associated with greater foreign assets and liabilities for that country.*

Figure 1 draws a scatter plot with institutional quality on the horizontal axis and two measures of international diversification on the vertical axis. The measures of international diversification are the ratios of foreign assets (and liabilities) to gross domestic product. The world distribution of assets and liabilities suggest that countries with better domestic institutions are also better diversified using greater cross-holdings.<sup>10</sup>

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<sup>9</sup>These are meant to capture the quality of local economic institutions, rather than specific investor protection laws. Laws are effective only when enforced, and enforcement is dependent mainly institutional quality. For example, common law countries typically have better investor protection codified in their laws; yet the list of common law countries includes Zimbabwe, where such laws can hardly be expected to be useful. On the other hand, the list of civil law, where investor protection laws are generally weaker, includes Germany, where the existent laws would possibly be better implemented than in a lot of common law nations.

<sup>10</sup>In OLS regressions reported in appendix A (A.2), institutions remain significant after controlling for factors that have been shown in the empirical literature to be important determinants of international diversification (Dahlquist et al. (2003), Kho et al. (2006), Faria et al. (2007), Coeurdacier (2008)), such as country size (GDP), the level of general development (per capita GDP), openness to trade (share of total trade in GDP), the level of financial development (domestic credit to GDP ratio), financial openness (Chinn and Ito (2008) index), and insider ownership (fraction of

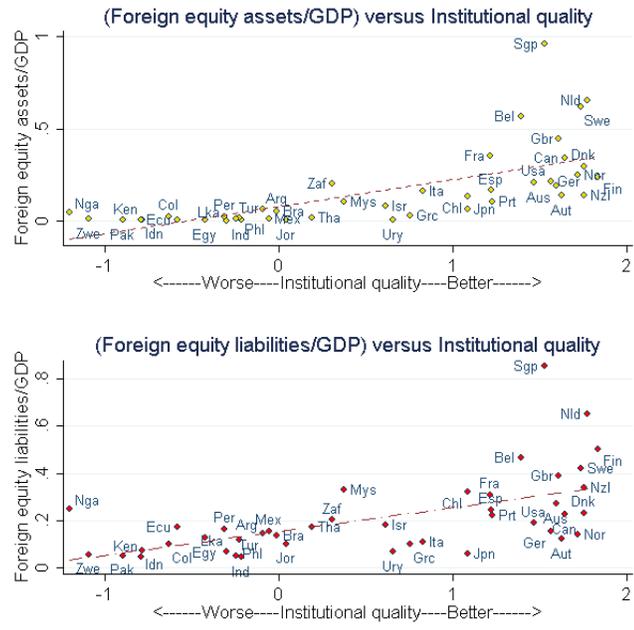


Figure 1.1: Better institutions associated with more foreign equity assets and liabilities. Each point represents the time average (1996-2004) for each country. Institutional quality measured by the Kaufmann et al. (2008) indices on the x-axis. The ratio of foreign equity assets (liabilities) to GDP in panel 1 (2) on the y-axis. Data source: Lane and Milesi-Ferretti (2007) and Kaufmann et al. (2008).

**Stylized fact 2.** *Better institutional quality in a country is associated with lower insider ownership in that country.*

The first panel of figure 2 plots the percentage of market capitalization of a country closely held, versus institutional quality, using a subset of 34 countries for which insider ownership data has been compiled by Kho et al. (2006). This shows countries having better institutional quality also exhibiting lower insider ownership. The second panel of figure 2 plots the ratio of foreign equity assets *plus* liabilities to GDP on the market capitalization closely held). The adjusted R-squares of the fitted lines are about 70%. The regressions for equity liabilities for my sample yield similar results to those reported by Faria et al. (2007) and Faria and Mauro (2009). Year-by-year regressions for the cross section (not reported here) show that the coefficient on the institutional index has grown larger over the sample period. I do not pursue a time-series analysis of how *changes* in diversification may have been affected by changes in institutional quality. This is because the time-variation in the institutional quality index for each country is much smaller than the variation across countries. The cross-sectional variance of institutional quality ranges from roughly 4 to 100 times the variance for individual countries.

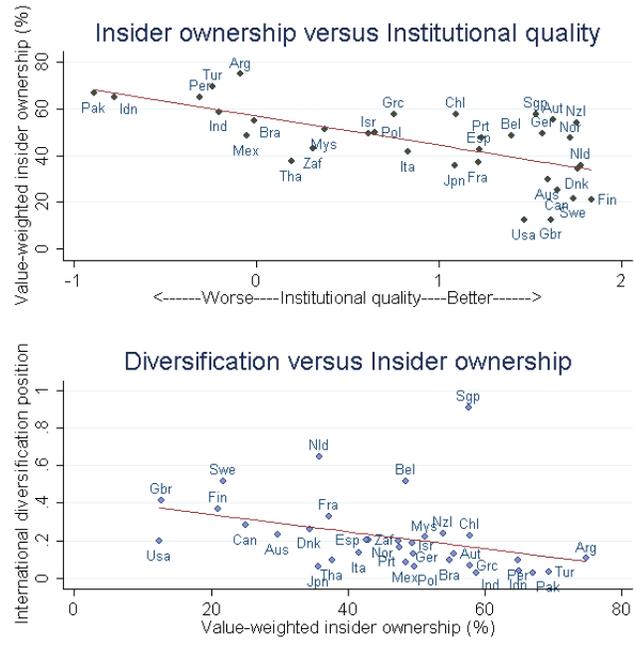


Figure 1.2: Better institutions associated with lower insider ownership; lower insider ownership associated with greater diversification. Each point represents the time average (1996-2004) for each country. Institutional quality measured by the Kaufmann et al. (2008) indices on the x-axis of panel 1. The value-weighted average percentage insider ownership in a country’s firms on y-axis in panel 1 and x-axis of panel 2. The ratio of foreign equity assets and liabilities to GDP on y-axis in panel 2. Data source: Kho et al. (2006), Lane and Milesi-Ferretti (2007) and Kaufmann et al. (2008).

vertical axis versus insider ownership. It makes a point about insider ownership and international risk sharing – the greater the fraction of financial claims on a nation available to be held by outsiders, the more internationally diversified a nation is. That is, freeing up a greater fraction of the float portfolio for outside investors leads to greater foreign cross holdings. Not all the freed domestic liabilities are held by domestic residents. Nor is all the freed wealth re-invested locally, as some of it finds its way abroad as an accumulation of foreign assets.

These facts raise several questions about portfolio allocation when insiders and outsiders co-exist. For instance, given a certain amount of insider ownership, what is the composition of ownership of foreign versus domestic investors? What will

happen when institutional quality improves in the South? Will the effects be felt mostly through an expansion of the world float portfolio, or also through portfolio adjustments by outsiders? I try to address these questions in a dynamic framework with insiders and outsiders.

### **1.3 A model of outsider portfolios with exogenous insider ownership**

This section lays out a model of international portfolio choice by outsiders with endogenous labor supply and asset returns. It extends the basic two-country, two-good framework developed by Backus et al. (1995) by embedding in it the free-cash-flow problem of Jensen (1986). The agency problem is incorporated in reduced form for analytical tractability, as in Albuquerque and Wang (2008). In what follows, I describe the economic environment in (1.3.1), the optimization problems of the agents in (1.3.2), and the concept of equilibrium in (1.3.3).

#### **1.3.1 Setup**

##### **1.3.1.1 Countries, firms and agents**

There are two countries in the world – North and South. North and South may differ in the quality of their institutions, with the South having weaker institutions. Institutional quality is modeled in a very specific way that will be described in detail later. In each country, there is one firm which produces an internationally traded intermediate good. There are four agents in the world, two agents in each of the two countries. One of them, labeled the insider, derives utility from consumption, and does not supply labor inputs. Her only source of income are dividends from the shares she owns in her own country’s firm, and private benefits of control, a concept that will be clarified later. The other agent, the outsider, is a worker-investor. She

earns wages from working in her own country's firm. She also has dividend income from the shares she holds in the domestic firm and the foreign firm.

### 1.3.1.2 The goods market

Each country produces an internationally traded intermediate good using capital (K) and labor (L).  $a(s^t)$  is produced only in the North, and  $b(s^t)$  only in the South.<sup>11</sup> Except for the total output of the intermediate goods in the North and the South, which are denoted by  $Y_a$  and  $Y_b$  respectively, all quantities associated with the South are superscripted with a “\*”. The production functions for the intermediate goods are

$$Y_a(s^t) = Z(s^t)K(s^{t-1})^\theta L(s^t)^{1-\theta} \quad (1.1)$$

$$Y_b(s^t) = Z^*(s^t)K^*(s^{t-1})^\theta L^*(s^t)^{1-\theta} \quad (1.2)$$

The only source of uncertainty is the technology in the intermediate goods sector of each country, described by the stochastic processes  $Z(s^t)$  and  $Z^*(s^t)$ . These evolve according to first-order auto-regressive processes driven by homoscedastic shocks  $\epsilon(s^t)$  and  $\epsilon^*(s^t)$ .

$$\log(Z(s^t)) = \rho_{11}\log(Z(s^{t-1})) + \rho_{12}\log(Z^*(s^{t-1})) + \epsilon(s^t) \quad (1.3)$$

$$\log(Z^*(s^t)) = \rho_{22}\log(Z^*(s^{t-1})) + \rho_{21}\log(Z(s^{t-1})) + \epsilon^*(s^t) \quad (1.4)$$

Both intermediate goods are used in the production of the final consumption-investment good in each country. The two intermediates are combined using a Cobb-Douglas

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<sup>11</sup>A reminder of standard notation: at each time  $t$ , the economy is in state  $s_t \in \mathbb{S}$ , where  $\mathbb{S}$  is the set of possible states of the world. The sequence of events from the start of time till date  $t$  is denoted by the history  $s^t$ .

technology that is not subject to uncertainty

$$Y(s^t) = a(s^t)^\omega b(s^t)^{1-\omega} \quad (1.5)$$

$$Y^*(s^t) = a^*(s^t)^{\omega^*} b^*(s^t)^{1-\omega^*} \quad (1.6)$$

This sets the elasticity of substitution between Northern and Southern intermediates to unity. A constant fraction of the value of final output is used in the purchases of each intermediate input. The Cobb-Douglas assumption is relaxed later.  $\omega$  and  $\omega^*$  are assumed to be greater than  $\frac{1}{2}$  to reflect an exogenous preference for domestic intermediates.

Let the price of the Northern and Southern intermediate be  $p_a$  and  $p_b$ , and the price index of each country's final consumption good be  $p(p_a, p_b)$  and  $p^*(p_a, p_b)$  respectively. Define  $q_a(s^t) = \frac{p_a}{p(p_a, p_b)}$ ,  $q_a^*(s^t) = \frac{p_a}{p^*(p_a, p_b)}$ ,  $q_b(s^t) = \frac{p_b}{p(p_a, p_b)}$ , and  $q_b^*(s^t) = \frac{p_b}{p^*(p_a, p_b)}$  as the intermediates prices in each country in units of the local final good. The real exchange rate between the two countries, which is defined as the price of the Southern final good relative to the Northern final good, can then be written in two ways,

$$e(s^t) = \frac{q_a(s^t)}{q_a^*(s^t)} \quad (1.7)$$

$$e(s^t) = \frac{q_b(s^t)}{q_b^*(s^t)} \quad (1.8)$$

by the law of one price for the traded intermediate goods. Defined this way, a depreciation of the real exchange rate for North is an increase in its algebraic value. The terms of trade for North, similarly, is defined as the price of its imports divided by the price its exports, both denominated in terms of its own consumption good

$$t(s^t) = \frac{q_b(s^t)}{q_a(s^t)} \quad (1.9)$$

so that an improvement in North's terms of trade is a decline in the algebraic value of  $t(s^t)$ .

### 1.3.1.3 Asset markets

There are two assets in fixed supply, equity in the Northern intermediate goods firm, and equity in the Southern intermediate goods firm. The supply of both assets is normalized to unity. Firms are entirely equity financed. Agents do not have access to a full range of Arrow-Debreu contingent claims, and can save and share risks by holding these two assets at most.

**Definition 1.** *A holder of an equity contract in the Northern (Southern) intermediate goods firm is entitled to dividend  $D(s^t)$  ( $D^*(s^t)$ ) at time  $t$  after the history of events  $s^t$ , paid in units of the final good of the country in which the firm is located.*

Let  $\lambda_{ij}(s^t)$  (where  $i, j = N, S$ ) denote the share of country  $j$  equity held by outsiders of country  $i$ .  $\alpha(s^t)$  and  $\alpha^*(s^t)$  denote ownership of own-country equity by the insider in the North and the South. Thus, asset market clearing requires

$$\lambda_{NN}(s^t) + \lambda_{SN}(s^t) + \alpha(s^t) = 1 \tag{1.10}$$

$$\lambda_{NS}(s^t) + \lambda_{SS}(s^t) + \alpha^*(s^t) = 1 \tag{1.11}$$

### 1.3.1.4 Description of agents: Insiders

This section lays out a bare bones description of the insider's optimization problem. A more complete discussion of how the insider affects the equilibrium comes in a later section (1.4.1). The insider has sole authority over the decisions of the representative domestic firm. I assume for the moment that the insider owns a fraction  $\alpha$  of the firm's equity, but cannot perform asset trades, so that she has her entire wealth invested in domestic equity. The insider has the following period-wise flow of income and consumption in the North.

$$M(s^t) = \alpha D(s^t) + q_a(s^t) f(s^t) Y_a(s^t) - \Phi(s^t) \quad (1.12)$$

where dividends,  $D(s^t)$  are defined by

$$D(s^t) = q_a(s^t) [\{1 - f(s^t)\} \{Y_a(s^t)\} - W(s^t) L(s^t)] - \{K(s^t) - (1 - \delta) K(s^{t-1})\} \quad (1.13)$$

$f(s^t)$  is the fraction of output extracted as private benefits of control, and  $\Phi(s^t)$  is the deadweight cost to the insider for doing so.<sup>12</sup> The cost of stealing is assumed to take the following functional form

$$\Phi(s^t) = q_a(s^t) \frac{\eta f(s^t)^2 Y_a(s^t)}{2} \quad (1.14)$$

which is quadratic in the fraction stolen and linear in the scale of stealing.<sup>13</sup> It depends on a parameter  $\eta$ , which captures institutional quality. Higher values of  $\eta$  correspond to better institutional quality.<sup>14</sup> The value of  $\eta$  may differ between the North and the South to reflect differences in institutional quality. When  $\eta$  differs between the two countries, it will be lower in the South.

Let us consider the insider's problem in the North. She chooses  $\{I(s^t), D(s^t), L(s^t), f(s^t)\}_0^\infty$ ,<sup>15</sup> which are investments, dividends, labor demand, and fraction of output extracted as

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<sup>12</sup>Think of  $\Phi$  as monetary bribes, the costs of running front companies, doctoring accounts or paying court-mandated fines in the event of litigation. I assume that this output is simply burnt and does not enter the consumption stream of any other agent.

<sup>13</sup>Fractional private benefits of control and a quadratic cost-of-stealing function are common modeling devices used in the corporate finance literature. See Shleifer and Wolfenzon (2002) and Kim and Durnev (2005) for empirical implementations, and Albuquerque and Wang (2008) for an example of a recent DSGE model which uses these functional forms to model the free cash flow problem.

<sup>14</sup>In other words, private benefits of control are easier to extract in certain countries due to institutional failures. This is consistent with the empirical evidence in Nenova (2003) and Dyck and Zingales (2006). Conversely, better institutions make it easier for outside investors to extract the free cash flow of a firm in the form of dividends, as in LaPorta et al. (2000b), and Dittmar et al. (2003).

<sup>15</sup>Note that in this section of the paper, the insider does not choose her own level of ownership. Endogenous insider ownership is explored in a later section.

private benefits. Her maximization problem, for a *given* level of ownership  $\alpha$ , is

$$\max_{\{I(s^t), D(s^t), L(s^t), f(s^t)\}} \sum_{t=0}^{\infty} \sum_{s^t} Q(s^t) (\alpha D(s^t) + q_a(s^t) f(s^t) Y(s^t) - \Phi(s^t)) \quad (1.15)$$

where  $Q(s^t)$  is the stochastic discount factor that the insider uses to price her own flow of income after history  $s^t$ .  $Q(s^t)$  is assumed to be

$$Q(s^t) \equiv \pi(s^t) \beta^t \frac{U'(M(s^t))}{U'(M(s^0))}$$

where  $U(M(s^t)) = \log(M(s^t))$  is the utility function of the insider, defined only over consumption. The Southern insider has a similar problem.

There are two forces of misalignment at work here: the assumption that the insider maximizes with respect only to her own flow of consumption, not the stream of dividends; and the discount factor used to value this consumption stream. Perfect alignment of interests amounts to the insider maximizing *dividends* with respect to the *correct* discount factor, which could be a ownership-weighted average of insider and outsider marginal utilities. I assume the polar opposite, that the stochastic discount factor in question does not heed the ownership of outsiders, and the insider maximizes her own consumption stream.<sup>16</sup>

### 1.3.1.5 Description of agents: Outsiders

There are two representative outsiders in the model, one a resident of the North and the other residing in the South. They have preferences over the final consumption good produced in their own country and leisure. The two outsiders take the wage earned at the domestic firm and the flow of dividends from the two representative intermediate goods firms as given and choose a sequence of consump-

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<sup>16</sup>See Danthine and Donaldson (2005) for a discussion on the alignment of discount factors between owners and managers. Quite intuitively, they find that an optimal remuneration package for the manager involves a component that is a function of aggregate labor income.

tion, labor supply and asset holdings. For example, the Northern outsider chooses  $\{C(s^t), L(s^t), \lambda_{NN}(s^t), \lambda_{NS}(s^t)\}_0^\infty$ . The maximization problem of the representative Northern agent is

$$\max_{\{C(s^t), L(s^t), \lambda_{NN}(s^t), \lambda_{NS}(s^t)\}} \sum_{t=0}^{\infty} \sum_{s^t} \beta^t \pi(s^t) U(C(s^t), L(s^t)) \quad (1.16)$$

subject to the period-wise budget constraint

$$\begin{aligned} C(s^t) + P(s^t)(\lambda_{NN}(s^t) - \lambda_{NN}(s^{t-1})) + e(s^t)P^*(s^t)(\lambda_{NS}(s^t) - \lambda_{NS}(s^{t-1})) \\ = q_a(s^t)W(s^t)L(s^t) + \lambda_{NN}(s^{t-1})D(s^t) + \lambda_{NS}(s^{t-1})e(s^t)D^*(s^t) \end{aligned} \quad (1.17)$$

We can also write this budget constraint in terms of a state variable, the outsider's financial wealth, and asset returns. Define financial wealth of the Northern outsider,  $\Lambda(s^t)$ , as the value of total holdings of assets after history  $s^t$ ,

$$\Lambda(s^t) \equiv P(s^t)\lambda_{NN}(s^t) + P^*(s^t)\lambda_{NS}(s^t) \equiv \Lambda_{NN}(s^t) + \Lambda_{NS}(s^t) \quad (1.18)$$

and asset returns in units of the local final good as

$$R(s^t) \equiv \frac{P(s^t) + D(s^t)}{P(s^{t-1})} \quad (1.19)$$

$$R^*(s^t) \equiv \frac{P^*(s^t) + D^*(s^t)}{P^*(s^{t-1})} \quad (1.20)$$

The budget constraint of the Northern outsider can then be written as

$$\Lambda(s^t) = q_a(s^t)W(s^t)L(s^t) + \Lambda_{NN}(s^{t-1})R(s^t) + e(s^t)\Lambda_{NS}(s^{t-1})R^*(s^t) - C(s^t) \quad (1.21)$$

or,

$$\Lambda(s^t) = q_a(s^t)W(s^t)L(s^t) + \Lambda(s^{t-1})R(\tilde{s}^t) - C(s^t) \quad (1.22)$$

where  $R(\tilde{s}^t) \equiv \frac{\Lambda_{NN}(s^{t-1})}{\Lambda(s^{t-1})}R(s^t) + \frac{\Lambda_{NS}(s^{t-1})}{\Lambda(s^{t-1})}e(s^t)R^*(s^t)$  is the weighted average return on the entire portfolio.

The felicity function is  $U(C(s^t)) = \log(C(s^t)) - V(L(s^t))$ , an assumption that is relaxed later.

### 1.3.1.6 Optimal combination of intermediate goods

The optimal combination of the two intermediate goods can be found by thinking of a proxy final goods firm in each country that takes input prices  $q_a(s^t)$  and  $q_b(s^t)$  as given to maximize profits every period. Thus their problem is static profit maximization.

$$\Pi = \max_{\{a(s^t), b(s^t)\}} Y(a(s^t), b(s^t)) - q_a(s^t)a(s^t) - q_b(s^t)b(s^t) \quad (1.23)$$

$$\Pi^* = \max_{\{a^*(s^t), b^*(s^t)\}} Y^*(a^*(s^t), b^*(s^t)) - q_a^*(s^t)a^*(s^t) - q_b^*(s^t)b^*(s^t) \quad (1.24)$$

Having a final goods firm in each country is just a convenient way to bypass specifying a price index for final consumption for each country. The real exchange rate between the two countries, which is defined as the relative price of their consumption bundles, is the same whether we model the aggregation as taking place in a final goods sector or in the utility function of the individual. Therefore, the final goods sector plays absolutely no role in any of the qualitative or quantitative results that follow.

### 1.3.2 First order and market clearing conditions

First, I set out the optimality and market clearing conditions of the decentralized economy, and then define the concept of equilibrium in the next section.

#### 1.3.2.1 First order conditions for the insider's problem

The Northern insider observes the history of states up to the period  $t$ ,  $s^t$ , and forms expectations on the future state  $s_{t+1}$ . Then she decides on investment, employment and amount of private benefits based on the following conditions.

$$\sum_{s_{t+1} \in \mathbb{S}} \frac{Q(s^t, s_{t+1})}{Q(s^t)} \left[ \theta \left( 1 + \frac{(1-\alpha)^2}{2\alpha\eta} \right) \frac{q_a(s^t, s_{t+1}) Y_a(s^t, s_{t+1})}{K(s^t)} + (1-\delta) \right] = 1 \quad (1.25)$$

This is the inter-temporal optimality condition for investment. Since the cash-flow ownership of the insider is limited to  $\alpha$ , she bears only a fraction of the costs of investment. But private benefits of control extracted are a fraction of the revenue of the firm. Thus she assigns a higher-than-optimal weight to returns on capital, over and above the normal marginal product of capital,  $\theta \frac{q_a Y_a}{K}$ . This is because her private pay-off from capital comes through dividends *and* private benefits.

$$W(s^t) L(s^t) = (1-\theta) \left( 1 + \frac{(1-\alpha)^2}{2\alpha\eta} \right) Y_a(s^t) \quad (1.26)$$

This is the period-wise labor demand function. Observe that the agency problem expands the share of labor income in output beyond  $(1-\theta)$  by a fixed amount  $\left( 1 + \frac{(1-\alpha)^2}{2\alpha\eta} \right)$ , which goes to 1 as institutional quality gets better, that is,  $\eta$  gets very large.

$$f(s^t) = \frac{1-\alpha}{\eta} \quad (1.27)$$

The last equation states that the insider steals a constant fraction of output in each

period and state, which follows directly from the quadratic cost of stealing that I assume. This simplifies the analysis substantially. There are a similar set of conditions for the South.

**Remark 1.** *The expression  $(1 + \frac{(1-\alpha)^2}{2\alpha\eta})$  that appears in the first two optimality conditions of the insider is the gross payoff (before deducting the insider's share of labor and investment costs) to the insider from dividends and private benefits of control (net costs of extracting that benefit) per unit of cash flow rights held. This payoff is lower, the better is the quality of domestic institutions (higher  $\eta$ ).*

Two conditions need to be imposed on the parameter  $\eta$  for the solution to be economically meaningful. The first is trivial, that the fraction of output consumed as private benefits should not exceed 1. Also, the optimal solution to the investment problem should not require infusion of new funds from investors in the steady state, which would make steady state dividends and stock prices negative. Obviously, ensuring the second condition is sufficient for the first to hold. Note that the condition holding in the non-stochastic steady state does not ensure that dividends are positive for all states of nature.

**Assumption 1.** *For given insider ownership  $\alpha$  and  $\alpha^*$ , the institutional quality parameters  $\eta$  and  $\eta^*$  are high enough so that dividends are non-negative in the steady state. These values are provided in the appendix.*

### 1.3.2.2 First order conditions for the outsider's problem

The outsider observes the history of states up to the period  $t$ ,  $s^t$ , and forms expectations on the future state  $s_{t+1}$ . Since expectations are rational, she can implicitly calculate expected dividend policy and current labor demand of the insider. She then solves for her own optimal consumption, labor supply and asset allocation, given the insider's behavior. The first order conditions for the outsiders are standard. The Northern outsider has the following optimality conditions for stock purchases

$$P(s^t) = \beta \sum_{s_{t+1} \in \mathbb{S}} \pi(s_{t+1}|s^t) \frac{U_C(s^t, s_{t+1})}{U_C(s^t)} \left( D(s^t, s_{t+1}) + P(s^t, s_{t+1}) \right) \quad (1.28)$$

$$e(s^t)P^*(s^t) = \beta \sum_{s_{t+1}} \pi(s_{t+1}|s^t) \frac{U_C(s^t, s_{t+1})}{U_C(s^t)} e(s^t, s_{t+1}) \left( D^*(s^t, s_{t+1}) + P^*(s^t, s_{t+1}) \right) \quad (1.29)$$

which is the standard asset-pricing Euler equation. The condition for hours worked is

$$\begin{aligned} U_C(s^t)q_a(s^t)W(s^t) + U_L(s^t) &\geq 0 \\ &= 0 \text{ if } L(s^t) > 0 \end{aligned} \quad (1.30)$$

There are a similar set of conditions for the South.

### 1.3.2.3 First order conditions for optimal combination of intermediates goods

The hypothetical final goods firms buy the two intermediate inputs in spot markets. Their optimality conditions for the use of inputs are

$$\omega Y(s^t) = q_a(s^t)a(s^t) \quad (1.31)$$

$$(1 - \omega)Y(s^t) = q_b(s^t)b(s^t) \quad (1.32)$$

such that the fraction of final output used to pay for intermediates is constant.

There are a similar set of conditions for the South. I stress again at this point that the introduction of the final goods firm is just an expositional tool. These “firms” do not have any profits, do not employ capital or labor, and just serve as a proxy for the

deterministic technology for assembling final goods from the two traded intermediates. In short, they play absolutely no substantive role in this model economy.

### 1.3.2.4 Market clearing conditions

Relative prices of intermediate goods,  $q_a(s^t)$  and  $q_b(s^t)$  adjust such that

$$a(s^t) + a^*(s^t) = Y_a(s^t) \quad (1.33)$$

$$b(s^t) + b^*(s^t) = Y_b(s^t) \quad (1.34)$$

The final consumption good market clearing requires

$$C(s^t) + K(s^t) - (1 - \delta)K(s^{t-1}) + M(s^t) = Y(s^t) - \Phi(s^t) \quad (1.35)$$

$$C_{m^*}(s^t) + K^*(s^t) - (1 - \delta)K^*(s^{t-1}) + M^*(s^t) = Y^*(s^t) - \Phi^*(s^t) \quad (1.36)$$

so that consumption demand by the representative outsider, investment demand and the consumption of the insider add up to the output of final goods.

Stock market clearing requires that

$$\lambda_{NN}(s^t) + \lambda_{SN}(s^t) = 1 - \alpha(s^t) \quad (1.37)$$

$$\lambda_{NS}(s^t) + \lambda_{SS}(s^t) = 1 - \alpha^*(s^t) \quad (1.38)$$

so that the total shares held by outsiders in a country's firms is constrained by the holdings of the insider. The fractions  $(1 - \alpha(s^t))$  and  $(1 - \alpha^*(s^t))$  are the *float*

*portfolios* in the North and the South.

### 1.3.3 Definition of equilibrium

An equilibrium in this model is a set of prices  $P(s^t)$ ,  $P^*(s^t)$ ,  $R(s^t)$ ,  $R^*(s^t)$ ,  $W(s^t)$ ,  $W^*(s^t)$ ,  $q_a(s^t)$ ,  $q_a^*(s^t)$ ,  $q_b(s^t)$ ,  $q_b^*(s^t)$ , and  $e(s^t)$  for all  $s^t$  and  $t$  satisfying the following conditions

1. *The insider's investment, employment and private benefits optimality conditions (1.25), (1.26) and (1.27) hold in the North. Analogous conditions hold in the South.*
2. *The outsider's stock purchase and labor supply optimality conditions (1.28), (1.29) and (1.30) hold in the North. Analogous conditions hold in the South.*
3. *Intermediate inputs are combined optimally according to conditions (1.31) and (1.32) in the North. Analogous conditions hold in the South.*
4. *Intermediate inputs resource constraints (1.33) and (1.34) hold worldwide.*
5. *Final goods resource constraints (1.35) and (1.36) hold in each country.*
6. *Asset markets clear according to constraints (1.37) and (1.38).*

In the equilibrium defined above, insiders make decisions regarding the investment, dividends, and labor demand of the intermediate goods firms. How their decisions influence the equilibrium is discussed in the following section (1.4.1). Outsiders take these decision rules as known and given, and formulate their consumption and labor supply plans. Additionally, they decide how much of their financial wealth to invest in each of the two available assets. Section (1.4.2) explores these portfolio shares.

## 1.4 Outsider portfolios

This section presents the key insights from the model regarding the general equilibrium effect of institutional quality and insider ownership on outsider portfolios. I

first discuss in section 1.4.1 how the insider’s decisions influence the second moments of variables that are crucial for the outsider’s portfolio decision. I then provide analytical solutions to the portfolio allocation problem of outside investors in terms of these second moments in section (1.4.2), for an *exogenous* amount of insider ownership. This is done under some simplifying assumptions – countries are symmetric, agents have logarithmic utility in consumption, and the final good is a Cobb-Douglas aggregate of intermediate goods. These analytical solutions show the direct link between the insiders’ investment decisions and outsider portfolios. I then implement a numerical technique to solve for asset prices and outsider portfolios for general functional forms in (1.4.4) and (1.4.5). Armed with these tools, I next define an equilibrium in which insider portfolios are endogenous, and solve for equilibrium holdings of both insiders and outsiders in section (1.5).

### 1.4.1 How does the insider influence the equilibrium?

The insider’s consumption  $M(s^t)$  has three components,

$$\underbrace{\alpha D(s^t)}_{\text{insider share of dividends}} \quad \underbrace{+q_a(s^t)f(s^t)Y_a(s^t)}_{\text{private benefits}} \quad \underbrace{-\Phi(s^t)}_{\text{cost of stealing}}$$

where dividends  $D(s^t)$  are defined by

$$\underbrace{q_a(s^t)(1 - f(s^t))Y_a(s^t)}_{\text{revenue net of private benefit}} \quad \underbrace{-q_a(s^t)W(s^t)L(s^t)}_{\text{labor costs}} \quad \underbrace{-\{K(s^t) - (1 - \delta)K(s^{t-1})\}}_{\text{investment}}$$

The agency problem in the model stems from the insider’s limited ownership of the firm and her ability to extract private benefits of control. Because the insider owns only a fraction  $\alpha$  of the firm, in effect  $(1 - \alpha)$  of her private benefits come from revenues that rightfully belongs to outsiders. The larger the share  $(1 - \alpha)$  owned by outsiders, the greater the incentive to steal. Thus, the optimal extraction of private

benefits of control declines with greater insider ownership and increases with greater outsider ownership as in Shleifer and Wolfenzon (2002) and Albuquerque and Wang (2006, 2008), as shown by the insider's optimality condition (1.27).

$$f(s^t) = \frac{1 - \alpha}{\eta}$$

Multiplying the expression for dividends by the insider's ownership share  $\alpha$  and inspecting the last two terms, we see that the insider pays for only a fraction  $\alpha$  of the labor and investment cost of the firm due to her limited ownership.

$$\underbrace{-\alpha\{q_a(s^t)W(s^t)L(s^t)\}}_{\text{insider share of labor costs}} \quad \underbrace{-\alpha\{K(s^t) - (1 - \delta)K(s^{t-1})\}}_{\text{insider share of investment}}$$

Since private benefits are proportional to firm size by assumption and the higher costs of a larger firm are partly subsidized by outside owners, the insider has an incentive to over-invest. Capital and labor being imperfect substitutes in production, a higher equilibrium capital stock also requires higher equilibrium employment. This distinguishes the agency aspect of the model in this paper from Albuquerque and Wang (2008), who focus only on over-investment.

As noted by these authors, there is also a separate reason that might make the insider *reluctant* to over-invest. Since the insider is risk averse and her consumption stream is derived entirely from the firm, over-investment reduces her utility by increasing the volatility of her consumption stream. Recall that the insider is not allowed to trade in other assets. This makes asset markets incomplete for the insider, because she has to insure against the two shocks in the world economy using a single asset, her fixed holdings in her own firm. This form of financial market incompleteness has real effects because the insider attempts to insure herself by affecting the pay-offs to the asset she holds. However, in their model as in this one, the incentive to over-investment dominates in equilibrium.

#### 1.4.1.1 How does the insider affect the outsiders' portfolios?

Because of similar goods and asset market setups, the model shares an important feature of Heathcote and Perri (2009) and Coeurdacier et al. (2009): relative (to the other country) labor income and asset income are negatively correlated. This result comes from three interconnected channels. First, a positive productivity shock in any country leads to an increase in labor income in that country. Second, it also leads to a worsening of the terms of trade for that country because of an increase in supply of the their intermediate good. This is the “automatic insurance” role of the terms of trade emphasized by Cole and Obstfeld (1991). However, the dynamics of investment dampens the decline in the terms of trade. Recall that the final investment good is made from Northern and Southern intermediates. Since the technology for producing the final good is biased towards domestic inputs, an increase in domestic investment due to the positive shock to technology increases demand for the domestic intermediate good, cushioning the worsening of the terms of trade. This leads to an overall increase of the labor income in the country experiencing the positive technology shock, relative to the other country. Third, the increase in domestic investment due to the technology shock also leads to a contemporaneous decline in dividends, relative to the other country. These three effects in conjunction induce a negative correlation between domestic labor income and domestic dividend income.

The same forces are at work in the present model. However, the presence of the insider serves as an amplifying mechanism in the connection between investment and the income processes of outsiders. Following a good productivity shock that is known to be persistent, insiders find it optimal to reduce dividends below first-best to finance privately optimal projects in expectation of higher future private benefits of control. Figure 3 (1.4.1.1) shows the simulated labor income and dividend paths from the model for the North and the South when the former has better institutions. In a country with good institutions, labor income and dividends are weakly positively

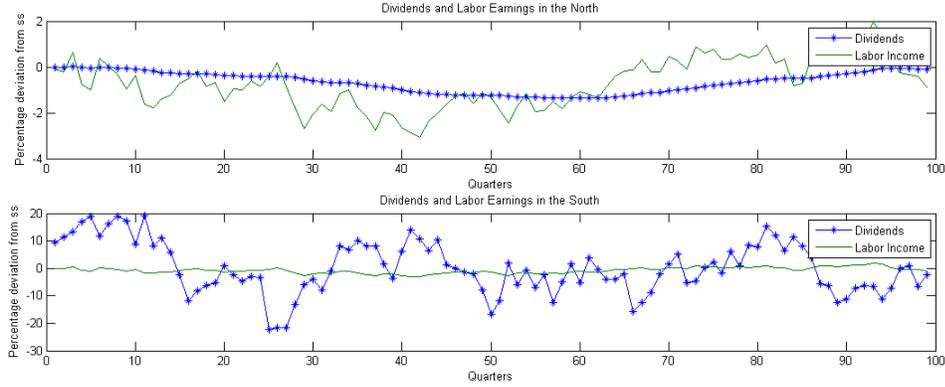


Figure 1.3: Southern dividends are relatively more volatile and negatively correlated with labor income. The top and bottom panel show simulated dividend and labor income paths in the North and South. The benchmark model has perfect institutions in the North. The dividend process for the South is for the model calibrated to the lowest decile of institutional quality.

correlated, whereas, this correlation is sharply negative in a country with poor governance. Note that dividends are also more volatile in the South, the vertical axis in each panel having different scales.<sup>17</sup>

#### 1.4.2 Analytical solutions to the outsider’s portfolio allocation problem

In this section I follow Heathcote and Perri (2004, 2009) in making a number of simplifying assumptions to solve for outsider’s portfolios. I assume that the two countries are *symmetric* in all respects. I also assume that the technology that combines Northern and Southern intermediates is Cobb-Douglas. Under these conditions, a constant portfolio rule for outsiders is derived. The purpose of this proposition is purely to provide intuition for the results of the numerical simulations that follow and to highlight the main qualitative mechanisms at work. The more interesting case of two countries with different institutional quality is explored numerically.<sup>18</sup> The solu-

<sup>17</sup>Note that this diagram plots only dividends and labor income, not these variables relative to the other country’s labor income and dividends.

<sup>18</sup>This problem, due to the ex-ante asymmetry of the countries in question, cannot be solved by the simple algebra used in this section.

tion in Proposition 1 can be thought of as equity positions that decentralize a central planner's problem that maximizes the equally weighted sum of outsider utilities, *given* optimal behavior by the insiders in each country.

**Proposition 1.** *There exists an equilibrium for this economy with own-country portfolio share for outsiders,  $\lambda_{NN} = \lambda_{SS} = \lambda$ , such that the consumptions of outside investors are equated across symmetric countries in all states of nature. The value of  $\lambda$  is given by*

$$\lambda = \frac{1 - \alpha}{2} + \frac{1}{2} \left\{ \frac{\psi_0(2\omega - 1)(1 - \alpha)}{1 - (1 - \psi_0)(2\omega - 1)} \right\} \quad (1.39)$$

where

$$\psi_0 = (1 - \theta) \left\{ 1 + \frac{(1 - \alpha)^2}{2\alpha\eta} \right\}$$

is labor's share of total income.

**Proof:** See appendix. (A.3.2)

#### 1.4.2.1 Intuition

The first piece in the solution is the minimum-variance portfolio used for pure diversification

$$\lambda_{\text{Div}} = \frac{1 - \alpha}{2}$$

which just says that the outsiders should hold half of the world float portfolio for the purpose of diversification. This is the same dictum that a simple consumption-based asset pricing model would deliver, which is to hold the world float portfolio in proportion to the agent's share in world wealth. Since only a fraction  $(1 - \alpha)$  of the world market portfolio is actually available for purchase, and by symmetry, each representative outsider owns half of the freely investible wealth in the world, they each hold  $\frac{1 - \alpha}{2}$ .

The second piece is the part of the portfolio which hedges against labor-income risk. As discussed in the previous section, the demand for this part of the portfolio comes from the endogenous negative correlation between labor and dividend income. The hedge portfolio is

$$\lambda_{\text{Hedge}} = \frac{1}{2} \left\{ \frac{\psi_0(2\omega - 1)(1 - \alpha)}{1 - (1 - \psi_0)(2\omega - 1)} \right\}$$

In this piece,  $\psi_0$  in the numerator is the share of labor income in GDP. This can be seen most easily by inspecting the first order condition for labor employment (1.26) and the expression for  $\psi_0$ . Also observe that as we let the cost-of-stealing parameter,  $\eta$ , go to very large values,  $\psi_0 \rightarrow (1 - \theta)$ , which is labor's share of income in the Cobb-Douglas production function. The higher labor income share  $\psi_0$  resulting from beyond optimal firm sizes increases this term, augmenting the extent of home bias.<sup>19</sup> Thus, home bias in equity portfolios increases with declining institutional quality due to increased demand for domestic shares from domestic residents for the purpose of labor income risk hedging. This demonstrates one of the channels by which the model generates cross sectional variation of asset holdings – the demand for the hedging component of outsider portfolios is more in countries with weaker institutions because there is more labor income to hedge. The other channel is an endogenous increase in the covariance between relative labor and dividend income. This channel is explored in the next section.

Note that there is no hedging demand when  $\omega = \frac{1}{2}$ . When this is the case, domestic investment is made up of equal proportions of the home and foreign intermediate. As described by Heathcote and Perri (2009), in this case increases in investment demand translate into equal increases in demand for the domestic and foreign intermediate goods, thereby having no terms of trade effects, *ceteris paribus*.

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<sup>19</sup>Under perfect alignment of interests, perfect institutional quality, and insider ownership close to zero, the portfolio described above converges to the portfolio in Heathcote and Perri (2009), which is  $\lambda = \frac{\omega + \theta - 2\omega\theta}{1 + \theta - 2\omega\theta}$ .

In their model, the crucial feature that drives the home bias result is the *asymmetry* of the two countries' investment composition and its effect on the dynamics of the real exchange rate.<sup>20</sup> The investment and terms of trade channel is eliminated when there is no home bias in investment.

In contrast, the mechanism of the present model is primarily driven by the asymmetry in the countries' institutions. In the case where we are able to solve for portfolios analytically, this channel is eliminated completely because we assume that the two countries have equally bad or good institutions. Thus, varying the institutional quality parameter in the symmetric case changes home bias by very little. But significant quantitative effects are seen when the two countries are allowed to be asymmetric. However, since this case has to be solved numerically, the purpose of Proposition 1 (and Proposition 2 in the next section) is to highlight the qualitative mechanism at work – which is, the moments of certain endogenous variables.

#### 1.4.2.2 Intuition using covariances of endogenous variables

Following Heathcote and Perri (2009), we can also write the portfolio as a covariance ratio of key endogenous variables.

**Proposition 2.** *The portfolio  $\lambda$  can also be expressed as*

$$\lambda = \frac{1 - \alpha}{2} - \frac{1}{2} \Psi \frac{\text{cov}(\Delta \hat{\mathbb{L}}, \Delta \hat{D})}{\text{var}(\Delta \hat{D})}$$

where

$$\Psi = \frac{\theta \psi_0^2 \omega^\omega (1 - \omega)^{1-\omega}}{(1 - \theta)(\psi_1 - \psi_0)(\frac{1}{\beta} + \delta - 1) - \delta}$$

and  $\Psi = \frac{\bar{\mathbb{L}}}{\bar{D}}$ ,  $\mathbb{L} = \bar{q}_a \bar{W} \bar{L} = \text{Labor income}$ ,  $D = \text{Dividends}$ ,  $\Delta \hat{\mathbb{L}} = \hat{\mathbb{L}} - \hat{e} - \hat{\mathbb{L}}^*$ ,  $\Delta \hat{D} = \hat{D} - \hat{e} - \hat{D}^*$ . Hats over variables denote log deviations from symmetric steady

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<sup>20</sup>In a related paper Civelli (2008) shows that what is crucial for the result is home bias in investment, not all of domestic absorption.

*state values and bars above variables denote symmetric steady state values.*

**Proof:** See appendix. (A.3.2)

As shown in a previous section, the presence of the insider affects the moments of the model's variables. Specifically, (i) it increases the relative volatility of the domestic dividend process, making the domestic asset relatively riskier and therefore *less* attractive to outsiders; (ii) it increases the covariance between relative labor and dividend income, making the domestic asset a better hedge against labor income risk and therefore *more* attractive to outsiders; (iii) it makes the steady state labor income to dividend ratio  $\frac{\bar{w}}{\bar{D}}$  higher, increasing the need to hedge labor income risk, thereby making the domestic asset *more* attractive to outsiders. Since the effect of (ii) and (iii) dominate (i), the hedge portfolio increases with worse institutional quality.

Common sense tells us that domestic equity capital should flee from countries that have weaker institutions. This idea is captured by the volatility effect (i). However, how much wealth is allocated to an asset depends not only on the relative variance of its payoff but also on the covariance of this payoff with other sources of risk, effect (ii) above. The remainder of the paper shows by numerical simulations that the effect of these covariances overturns the riskiness of assets from the South, making them desirable for Southern worker-investors.

### 1.4.3 Related literature

The papers that are closest to mine are Albuquerque and Wang (2006, 2008), referred to as AW (2006) and AW (2008). AW (2006) study the investment and exchange rate effects of investor protection. They solve for equilibrium consumption allocations of outsiders under the assumption of asset market completeness and find portfolios that support these allocations. In their equilibrium, outsiders in each country hold claims on each other that are independent of the degree of investor

protection. In the present paper, the focus is on portfolio allocation when the available assets are just equity in Northern and Southern firms. On the production side, the present model uses labor inputs, and this brings inefficient employment as an additional source of misalignment of incentives between insiders and outsiders. The inclusion of labor turns out to have implications for hedging labor income risk, and makes outsider portfolios dependent on institutional parameters.

AW (2008) is a closed economy variant of AW (2006) that examines the effects of poor corporate governance on investment and output. It has a risk averse insider who is allowed to trade in a risk-less asset and consumes dividend earnings plus private benefits, and an outsider whose consumption is financed solely by domestic dividends. The ratio of the marginal utilities of these two agents between different states and dates turn out to be the same because of the underlying structure of logarithmic utilities and linear private benefits, so that their marginal rates of substitutions coincide. Thus, in equilibrium, there is no incentives for asset trade between insiders and outsiders for *any* level of insider ownership, which is not true here because outsiders' consumptions are also affected by pay-outs of the foreign equity that they hold in equilibrium. Also, insiders have incentives to reduce holdings in their own firm for the purpose of diversification due to the presence of a second risky security, foreign equity. Thus, the focus of both AW (2006) and AW (2008) is on the cross-section of macroeconomic aggregates like investment, stock market volatility, exchange rates and stock prices, while I attempt to quantify the connection between institutional quality and country portfolios.

The results on home bias presented in this paper are closely related to those in Heathcote and Perri (2009), referred to as HP (2009). Specifically, the solution in Proposition 1 approaches the portfolio in HP (2009) when three conditions are satisfied: (i) institutional quality in both countries is perfect; (ii) insider ownership in both countries is very close to zero; (iii) there is perfect alignment of interests

between the insider and the outsider, in the sense that the insider uses a weighted average of discount factors of the firm's owners to value the stream of dividends.

#### 1.4.4 Numerical solutions of the general model

This section solves the model numerically for two reasons. First, one needs solutions to the optimal time-paths for non-portfolio variables in order to verify the intuition provided in the previous section. Second, the time-invariant portfolio rule derived in the previous section works only under the assumption of log utility, Cobb-Douglas aggregation, and symmetric countries. The simple algebra used to solve for portfolios rests entirely on the linear structure that comes out of the logarithmic utility and Cobb-Douglas final goods aggregation. It is of interest whether the result of Proposition 1 is robust to more general specifications of utility and technology. Also, solving for portfolio positions when the countries are asymmetric is especially crucial, because the motivation of the paper is the observed heterogeneity of institutions in different countries. For the numerical solution, the insider and outsider both have power utility, which nests logarithmic utility as a special case when the elasticity of inter-temporal substitution, and co-efficient of risk aversion are both 1;<sup>21</sup> the final good is made using Armington technology; also, the countries are asymmetric, in that the level of insider holdings ( $\alpha$ ), and the quality of institutions ( $\eta$ ) are allowed to be different.

Following perturbation techniques, I find second order Taylor-series approximations of the optimal decision rules for the control variables, and the transition equations of the endogenous state variables using the algorithms provided in Schmitt-Grohé and Uribe (2004). The details of this method are reviewed in section (A.4.2). I follow Devereux and Sutherland (2007) and Tille and Wincoop (2008) in choosing, for the non-portfolio variables, the non-stochastic steady-state of the model as the

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<sup>21</sup>Though these two parameters arguably have very different implications for portfolio allocation, I do not attempt to differentiate between them using Epstein-Zin utility.

approximation point. As is well known, portfolio shares are indeterminate in the steady-state. Thus, after the first step of choosing the approximation point for non-portfolio variables, I approximate the dynamics of the model at different guesses for the portfolio shares. In the next step I use certain criterion to choose between the different approximation points for portfolio shares to come up with the steady-state portfolio value. As detailed in Judd and Guu (2001) and Devereux and Sutherland (2007), this amounts to finding a *bifurcation point* (see Judd (1998), Judd and Guu (2001)), which is the intersection of the set of stochastic and non-stochastic solutions of the model. The details of this procedure is described in section (1.4.4.1).

#### **1.4.4.1 Choosing the portfolio approximation point**

As discussed in recent papers like Devereux and Sutherland (2006, 2007) and Tille and Wincoop (2008), solving portfolio-choice DSGE using local approximation techniques is problematic because the portfolio choice problem is irrelevant in the non-stochastic steady-state, which is the approximation point used in such an approach. Without uncertainty it does not really matter which agent owns which stream of dividends, as long as their budget constraints hold. For example, if the countries are symmetric and thus are equally wealthy ex-ante, any mirror-image asset holdings can be used to support the steady-state levels of consumption in each country. As a result, portfolio shares are indeterminate at the determinate steady-state for other non-portfolio variables like capital stock and consumption. Thus, we need to pick out the true steady-state portfolios of a stochastic economy from the infinite possibilities that arise in the non-stochastic economy.

To do this, I simulate the economy around all points in a fine grid of steady state portfolio allocations. I store the data generated from these simulations and use certain criterion to pick the correct approximation point. First of all, recall that markets are effectively complete for the outsider. This means that there exists

equilibrium portfolio shares such that the Backus and Smith (1993) full risk-sharing condition holds between outsiders of the two countries. For example, with power utility, it must be that at the neighborhood of the true equilibrium

$$\gamma \hat{c} = \hat{e} + \gamma \hat{c}^*$$

where  $\gamma$ ,  $\hat{c}$ ,  $\hat{e}$ , and  $\hat{c}^*$  are the coefficient of relative risk aversion, and log-deviations from an approximation point, of Northern outsider consumption, the real exchange rate, and Southern outsider consumption respectively. I search for that point for which the squared approximation error (S.E.) for this condition, up to a second order approximation, is the least. In essence, this is the numerical counterpart of solving for an equilibrium using the first order conditions of a planner's problem. Let  $\hat{\epsilon} = \gamma \hat{c} - \hat{e} - \gamma \hat{c}^*$ . I choose the steady state  $\lambda$ s to minimize

$$\text{S.E.}_{\hat{\epsilon}} = (\hat{\epsilon} - \bar{\hat{\epsilon}})'(\hat{\epsilon} - \bar{\hat{\epsilon}})$$

In the general model of this section, portfolio allocations are not time-invariant, as in the simplified version of the model in the previous section. Once we have the correct approximation point, which by definition will be the average portfolio holding if the model is simulated around that point, I use the decision rules to simulate a distribution of asset holdings. To test the accuracy of this method, I follow Heathcote and Perri (2009) in comparing the numerically derived choice of steady-state portfolios for symmetric countries, to the analytical solution derived in Proposition 1 in section 1.4.2. This provides a robustness check for the method used.

#### 1.4.5 Robustness checks: simulations of the general model

Simulations confirm that Proposition 1 carries through to the general case. In the following simulation, I fix the quality of institutions in one country (North) to very

high levels (high  $\eta$ ), and vary  $\eta$  for the other country (South). When I select the portfolio steady-state using the method described in the previous section, outsider portfolios are home-biased, and the degree of bias goes down with better institutional quality. The following table gives some simulated average values of portfolios for the two countries differing in the quality of institutions in the South, for a fixed level of insider ownership in each country ( $\alpha = 0.01$ ,  $\alpha^* = 0.5$ ), and perfect quality institutions in the North. The numbers for insider ownership are chosen in this simulation so that one can easily see that the portfolio positions add up to 0.99 in the North and 0.5 in the South.

Table 1.1: Average portfolios with different institutions in the South

Value of $\eta^*$	$\lambda_{NN}$	$\lambda_{SN}$	$\lambda_{NS}$	$\lambda_{SS}$
10	0.9738	0.0162	0.0628	0.4372
20	0.9074	0.0826	0.1313	0.3687
100	0.8531	0.1369	0.1479	0.3521
$10^{10}$	0.84	0.15	0.15	0.35

Going down column 1 of the table, as we increase the value of the institutional quality parameter, outsider portfolios become less home-biased. These numbers can be given a cross sectional interpretation. As we move down the column for  $\lambda_{SN}$ , we see that countries with better institutional quality will hold more international assets. Likewise, moving down the column for  $\lambda_{NS}$ , we see that such countries with should also be associated with higher levels of international liabilities. This pattern corresponds closely with the stylized facts noted before.

#### 1.4.6 How well does the model explain the cross sectional dispersion of home bias?

The purpose of these exercises is to see if the model can come close to replicating the data. I use the group of 43 countries for which stylized patterns were presented

earlier. I try to see if the model can replicate the degree of home bias in equity assets. First, regressions confirm that trade openness and institutions are the two most important cross-sectional determinants of international diversification for this group, as predicted by the model. Qualitatively speaking, the model predicts (from Proposition 1) the correct sign of the regression coefficients – that countries more open to trade and with better domestic institutional quality will hold more foreign assets as a fraction of their wealth.

The numerical exercise proceeds as follows. I take one country (North) and set insider ownership there to be equal to the value for the US (12.35%) reported in Kho et al 2006. This is the lowest value of insider ownership in the sample. In terms of the model,  $\alpha=0.1235$ . I set institutional quality in this country to be perfect, i.e.,  $\eta$  is set to an arbitrarily large value. For the other country (South), I fix insider ownership to the median insider ownership in the sample (48.45%). In terms of the model, this means  $\alpha^* = 0.4845$ . Then I vary the quality of institutions (the parameter  $\eta^*$ ) to match different deciles of private benefits of control as a fraction of firm value in the South using estimates from Dyck and Zingales (2006). For each value of  $\eta^*$ , I solve for the equilibrium fraction of wealth held in domestic and foreign assets for each of the two countries. This gives me 10 points. At one end are two symmetric countries with perfect institutions and the foreign asset holdings of any one of them (because they are symmetric). At the other end is one country with perfect institutions and another with private benefits in the 10th decile, and there are 8 more such points in between.

Figure 4 plots the results. I regress diversification on a set of controls other than institutional quality, and take the residuals of that regression as the data points I am trying to explain. In that case, a model without the corporate governance friction, trivially, would not be able to explain *any* of this variation, while the present model explains the cross-sectional dispersion of home bias.

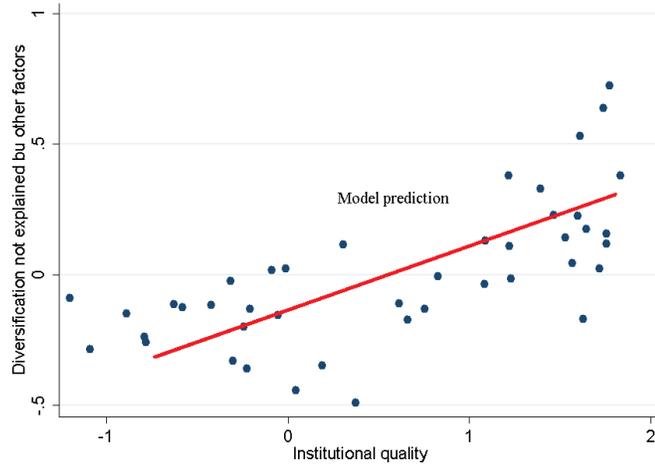


Figure 1.4: Model versus data. Each dot represents the residuals from a regression of average (1996-2004) diversification for each country on control variables other than institutional quality. Institutional quality on x-axis. Thus, the scatter plot shows the partial correlation in the data between portfolios and institutional quality. The line shown is that fitted by OLS to data generated from the model.

#### 1.4.6.1 The cross-sectional dispersion of investment volatility

The model also has clear predictions about the cross sectional variation of the second moments of some observable macroeconomic aggregates. For example it predicts that the amplitude of investment fluctuations from peak to trough should go down with better institutions. Figure 5 is a scatter plot of the standard deviation of the growth rate of fixed capital formation versus institutional quality. A regression with the usual controls used in this paper indicate institutions as the only significant variable. The years used are 1996-2004. A longer time sample yields the same cross-sectional dispersion.

## 1.5 Endogenous insider ownership

This section extends the model in the previous sections by letting insiders choose their portfolios. In order to maintain tractability, I make the simplifying assumption

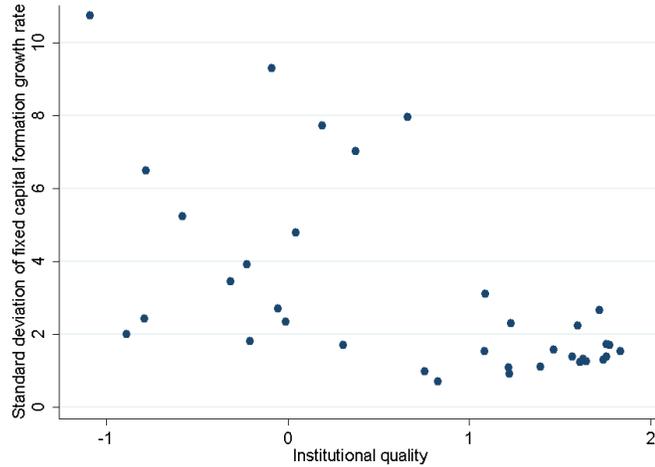


Figure 1.5: Investment volatility goes down with stronger institutions. Each dot represents the standard deviation (1996-2004) of fixed capital formation growth rate for a country. Institutional quality measured by the Kaufmann et al. (2008) indices on the x-axis.

that the insider trades her shares only once during the horizon of the model. This is a reasonable simplification in the light of two empirical observations: Kho et al. (2006) note that the time series for average insider ownership around the world shows little variation, the reasons for which will be clear in the discussion at the end this section; also, there is ample evidence that insiders face large fixed costs of trading in their control blocks because of several factors such as asymmetric information between insiders and the market (Goldstein and Razin (2006)), price impacts of large share sales because of negatively sloped demand curve for assets (Shleifer (1986), Chari and Henry (2004)), and the presence of private benefits of control (Nenova (2003), Dyck and Zingales (2006)). Thus, starting at some level of insider ownership,  $\alpha_0$  at  $t = 0$ , insiders trade in shares of country portfolios, and this fixes insider ownership  $\alpha$  for the rest of time, as in the previous sections. When making this decision, insiders take the optimal reaction function of all other agents from time  $t = 0$  onwards as given.

Models such as Shleifer and Wolfenzon (2002) show that better investor protection leads to more diffuse ownership of assets in a static, risk-neutral framework. When

firms are equity financed, better investor protection and corporate governance increase the amount of pledgable income for outside investors, increasing the availability of external financing. The intuition as to why better institutional quality leads to lower insider ownership in a dynamic model is quite simple. There are two forces at work. The first is a risk-averse insider's desire to diversify internationally by lowering her ownership. However, poor institutional quality prevents insider from diversifying their positions in the domestic index, because lower ownership increases their incentives to extract private benefits of control. This reduces the value of the domestic index for outsiders. Outside investors take this into account, and hence any attempt to reduce ownership leads to downward revisions of stock prices, and hence, the value of the insider's holdings. This imposes a "transaction" tax on portfolio adjustments by insiders in markets with poor institutional quality.<sup>22</sup> The level of country insider ownership is determined when these two forces, the diversification benefit of the insider, and the penalty for reducing her stake, balance out.<sup>23</sup>

### 1.5.1 Algorithm for computing insider ownership

Recall from previous sections that I have in place a method for computing stock prices and the portfolio allocation of outsiders, given a certain level of insider holdings. Now, I start with a certain level of Southern insider holdings in the two risky securities, Northern and Southern equity. Let this be  $(0, \alpha^{*'})$  initially, so that the Southern insider holds equity only in the South. I assume that the North has perfect institutions and fixed low insider ownership. Let there be an additional period  $t = -1$  just prior to  $t = 0$ . In this period, only the Southern insider chooses her holdings of the two risky securities, Northern and Southern equity. She trades the securities at prices

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<sup>22</sup>This effect has been analyzed in the finance literature by Admati et al. (1994) and DeMarzo and Fishman (2007).

<sup>23</sup>Note that the insider takes into consideration the impact of her sale of shares on the price of these shares when deciding how much to sell. Thus the insider does not act as a price taker as in perfectly competitive markets.

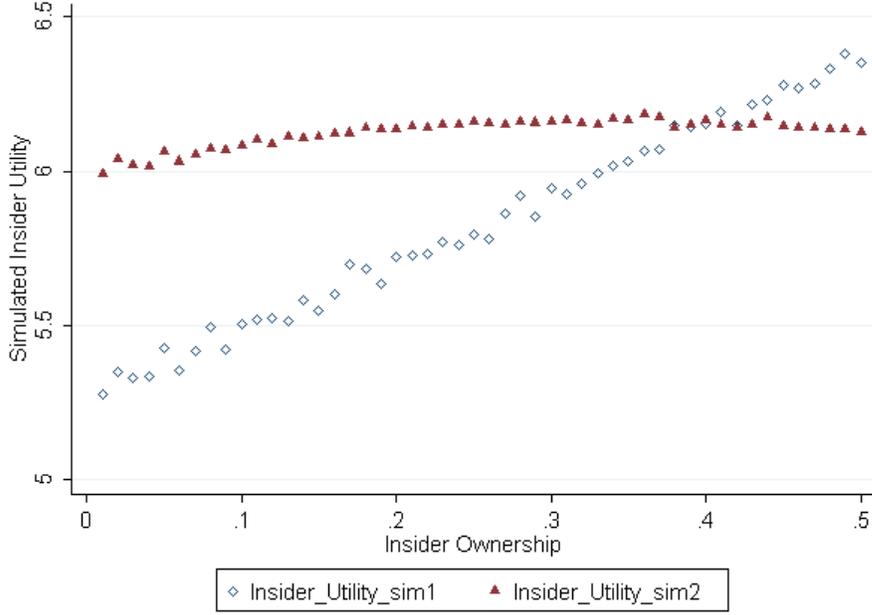


Figure 1.6: Optimal insider ownership goes down with better institutions. Each dot represents the average utility of the Southern insider when the model is simulated for 1000 periods at each level of insider ownership. The negatively sloped line is for weak institutional quality.

$(P(\alpha), P^*(\alpha^*))$ , where  $\alpha^*$  is the final holdings of Southern equity of the Southern insider. Note that because the insider is unable to commit to a certain level of the value-reducing action because of imperfect corporate control, the stock price depends on the *final* holdings of the insider,  $\alpha^*$ , rather than the initial holdings  $\alpha^{*'}$ , as in Admati et al. (1994) and DeMarzo and Urošević (2006).

The time-line is as follows. In period  $t = -1$ , the Southern insiders announces desired holdings  $\alpha^*$  for time  $t = 0$  to  $\infty$ . Enforceable contracts are written between the Southern insider, and outsiders in each country, that the insider will sell  $(\alpha^{*' - \alpha^*)$  units of Southern stock and will receive a share of the Northern stock index at prevailing prices. In period zero, as agreed in the previous period's contract,  $\alpha_{SN} = \frac{(\alpha^{*' - \alpha^*)P_0(\alpha^*)}{P_0(\alpha)}$  units of the Northern stock index are delivered to the Southern insider. Also, trade takes place between outsiders and portfolio holdings  $\{\lambda_{NN}, \lambda_{SN}, \lambda_{NS}, \lambda_{SS}\}$  are established. The insider takes into account the effect her fi-

nal holding has on the stock price, and consequently, her wealth, when she announces her desired holdings  $\alpha^*$ . So she chooses  $\alpha^*$  to maximize her discounted lifetime utility.

$$\alpha^*(\alpha^*) = \operatorname{argmax}_{\alpha^{**}} \{V_e(\alpha^{**})\} \quad (1.40)$$

I describe the numerical algorithm used to evaluate the best  $\alpha^*$  in A.4.4. In short, I evaluate the discounted lifetime utility of insiders for various insider ownership stakes.

Figure 6 plots the result. The downward sloping line (simulation 1) shows Southern insider utility for various levels of insider ownership when institutions are weak. Since the stock price falls when the post-trade equity held by the insider goes down, there is a fall in the insider’s wealth. As a result, she gets very few Northern stocks in exchange for her stake. Thus, though she retains private benefits of control, her lifetime utility falls because her total dividend income falls. The insider has no incentive to diversify because weak institutional quality acts as an endogenous “transaction tax” on her portfolio adjustments. The other line (simulation 2) shows average insider utility for various levels of insider holdings when institutional quality is perfect. Note that there is a slight gain from diversification and there exists an optimal amount of diversification for the insider when Southern institutions are strong. Thus, ownership tends to remain concentrated in the South as long as institutions are weak. Also, this yields the feature that we see in the data (see also LaPorta et al. (1999)), that countries with weaker institutions have more insider ownership.

## 1.6 Conclusion

I analyze the international portfolio diversification problem of small, security-only investors in the presence of insider ownership, corporate governance frictions, and non-diversifiable labor income risk. The main message of the paper is that imperfect corporate governance influences the dynamics of investment in ways that makes equity

in domestic firms a better hedge against fluctuations in labor income for residents in a country with poor institutions. This creates a preference for home assets in countries with poor institutions, a cross-sectional prediction that is consistent with empirical evidence presented in the paper. I also solve the model numerically for the optimal amount of insider equity, and demonstrate the link between insider and outsider portfolios in general equilibrium.

Common sense tells us that domestic equity capital should flee from countries that have weaker institutions. This idea is captured by the model as an increase in the volatility of dividends in a country with weaker institutions. However, how much wealth is allocated to an asset depends not only on the relative variance of its payoff but also on the covariance of this payoff with other sources of risk – herein lies the key insight of the paper. Contrary to intuition, I find that domestic outside investors in countries with weaker institutions will hold more of their own country’s float portfolio *because* it has weaker institutions.

Though most of the stock of international assets is held by a handful of countries with similar, well-developed capital markets, nations where investor rights are relatively weak are playing an increasingly important role in international capital movements. Understanding how agency problems affect macroeconomic aggregates and portfolio allocation thus constitutes an important set of open questions which this paper tries to address. An extension of the work in this paper would seek to provide a fully dynamic framework which yields sharper quantitative predictions about the degree of insider ownership, and the exact magnitudes of foreign diversification of countries under different institutional quality. Such an extension would be better able to address questions about the time-path of asset portfolios after financial liberalization and institutional reforms. These issues, and a more complete empirical test of the mechanism by which the model generates home bias is left for future work.

## CHAPTER II

### Fire-Sale FDI or Business as Usual?

#### 2.1 Introduction

*“...it happens because those with enterprize haven’t the money, and those with money haven’t the enterprize, to buy stocks when they are cheap.”* — Benjamin Graham (“Should Rich but Losing Corporations Be Liquidated?”, Forbes Magazine, 1932)

Financial crises characterized by capital flow reversals and a shortage of liquidity for the private sector have been recurrent phenomena in modern financial markets (Kaminsky and Reinhart (1998, 2000); Kaminsky et al. (2003)). During such episodes, leveraged firms in affected countries find themselves unable to make payments on short-term debt due to concurrent macroeconomic decline, or fail to convince financial markets to roll their debt over. Hence, they are forced to sell assets that they normally would not part with, issue new financial claims that might dilute the value of existing ones, or declare bankruptcy altogether to tide over a short-term liquidity crunch or lack of market confidence. In these circumstances, domestic firms that are not liquidity-constrained, and foreign firms which have access to their own capital markets, internal or external, buy these assets. This leads to a reallocation of ownership in countries affected by crises. A prominent example is the Asian financial crisis of 1997-1998, during which there was a surge of FDI in the form of MA in the

countries affected by the crisis (Aguiar and Gopinath (2005), Acharya et al. (2007)) because domestic firms were severely liquidity-constrained.<sup>1</sup>

Though the macroeconomic causes and effects of such crises themselves have been extensively studied, the ownership reallocations of productive assets that result are not very well understood. This is a serious shortcoming, because it is not obvious that markets necessarily allocate assets to their best possible users at times when liquidity is lacking and there exist other market imperfections.

This paper uses panel data on a group of emerging market divestitures compiled from the SDC MA database to investigate this question. First, we establish some stylized facts about MA in a group of countries that were affected by the 1997-1998 financial crisis. We find that the number of transactions in the MA market involving foreign buyers increased sharply during the time of the crisis, and more transactions took place in which the acquiring firm was from the financial sector or from a sector different than the target.<sup>2</sup> We then evaluate the reallocations of ownership in the period of crisis by a single metric – the evolution of the divestiture probability after an acquisition.<sup>3</sup> We look at the fate of acquisitions by tracking them across time to see if the probability of divestment was significantly different for acquisitions completed during the crisis period, and if survival rates were different for foreign versus domestic acquisitions. We find evidence that the survival-times of foreign acquisitions in crisis-hit countries (versus countries less affected by the crisis) were shorter than domestic ones, and that pairings between firms from different SIC sectors, and acquisitions by

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<sup>1</sup>The Asian financial crisis is said to have started on July 2<sup>nd</sup> 1997, when Thailand, sitting on an explosively large stock of foreign-currency-denominated debt, let the Baht float. Subsequent depreciation of the currency led Japanese commercial banks to start withdrawing from Thailand, and later Korea. This in turn led European banks to pull out, dragging Indonesian and Malaysian firms into similar liquidity crises.

<sup>2</sup>Often, targets have assets that are better re-deployed by local acquiring firms, for instance retail banking (Acharya et al. (2008, 2009)). That most sectors saw more foreign investment than usual can thus be interpreted as a reduction in the average match quality between acquiring and target firms.

<sup>3</sup>The efficiency and success of acquisitions have been judged in the literature using data on divestitures, see for example Kaplan and Weisbach (1992).

foreign financial firms were less likely to last if conducted during the crisis.

Motivated by these patterns, we then build a stylized model of the MA process where an acquiring firm searches for a target. As in the classic Diamond-Mortensen-Pissarides job search framework, the transaction price is not the only determinant of whether a match occurs. In addition, there exists a congestion externality by which the ease of search for either party depends on the *aggregate* state of the market.

In our model, a financial crisis is framed as an unanticipated decline in the bargaining position of target firms vis-à-vis acquiring firms. Thus, a crisis leads to two effects. First, it depresses asset prices of target firms.<sup>4</sup> Second, it increases the attractiveness of searching for the average acquiring firm because it can get a better deal when asset prices are lower. As a result, more acquiring firms search for targets. This externality makes it easier for the average target firm to find a match. This lowers the average “quality” of the match between acquiring firms and target firms in the sense that more matches take place that would not have occurred when macroeconomic conditions were better. This endogenously leads to a faster rate of dissolution of such matches when macroeconomic conditions rebound and the congestion externality abates. These predictions of the model are consistent with the facts noted before on MA conducted during the Asian crisis.

The rest of the paper is organized as follows. We review the existing literature in section 2.2 and present some stylized facts about MA during the Asian crisis in section 2.3. We then build a simple model of MA in section 2.4 and relate it to our stylized facts in section 2.5. Section 2.6 discusses our results and concludes.

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<sup>4</sup>This leads to lowered collateral value, which might trigger a new spiral of fire sales. This creates a novel mechanism by which financial shocks are amplified.

## 2.2 Literature review

### 2.2.1 What do we know about so-called fire-sale FDI?

Academic interest in the topic of fire-sale FDI in East Asia during the crisis period of 1997-1998 originated in a contemporary piece by Paul Krugman.<sup>5</sup> Krugman (2000) cited anecdotal evidence that assets in the crisis countries sold at sub-par prices because of the liquidity crunch faced by these economies, large quantities of short term debt being recalled at the same time as local currencies were plummeting. Since this was a macroeconomic credit event, the victims of fire-sales were not only firms in the financial sector, but also in other sectors like manufacturing. Krugman's article, along with others such as Loungani and Razin (2001) and Mody and Negishi (2001), raised several interesting welfare and policy related questions, such as the possibility of over-investment by foreign firms due the circumstances of a fire-sale, and the relative desirability of FDI over other forms of capital flows such as equity investments and debt.

Aguiar and Gopinath (2005) is one of the few papers which investigates the issue of fire-sales in more detail. They find that the number of foreign MA increased by 91% in the period leading up to and after the liquidity crisis in Asia, the years 1996-98; at the same time domestic deals fell by 27%. The probability of a firm being acquired is found to be a decreasing function of the firm's liquidity position, while the offer price to book value ratio turns out to be an increasing function of firm liquidity, suggesting distress sales. The two above liquidity effects were prominent in 1998 only, suggesting that aggregate liquidity was a determinant in these sales. As a robustness check they also look at similar deals in Singapore and Taiwan, which escaped the crisis, and find that liquidity effects were not important. Acharya et al. (2007) looking at FDI in the financial sector of the crisis-hit countries find that the increased FDI flows were

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<sup>5</sup>Pulvino (1998) examines asset fire-sales for the aircraft industry in the United States, and confirms the common wisdom that such asset sales do occur on a systematic basis.

associated with acquisition of majority stakes, which favors an agency-theoretic view of FDI, that it lowers agency costs between investors and entrepreneur-managers by transferring control rights to the investor ; and they find evidence of some of these asset sales being reversed subsequently. Specifically, they find that flips are more common among foreign acquisitions than domestic ones, and the party to which the flip is sold off is more often domestic.<sup>6</sup>

However, a number of criticisms of the fire-sale view of the FDI surge in Asia can be made. One of the simplest observable results of a fire-sale acquisition should be large abnormal returns for the acquiring firm. However, Chari et al. (2007), using a wider range of countries and a longer time period, and employing an event-study methodology, find that developed market acquiring firms experienced significant positive abnormal returns to emerging market acquisitions. This is at odds with the consensus in the developed market MA literature, that acquisitions on aggregate destroy value for shareholders. They find that this result is robust across time periods and not dependent on the presence of a crisis in the target country.<sup>7</sup> Thus, the fact that acquisition returns are not strongly dependent on the time period calls the fire-sale view of crisis-period FDI into question. Interestingly, Jensen (2005) and Shleifer and Vishny (2003) note that the end of the 90s was a boom time for mergers and acquisitions. Moeller et al. (2005) find that in the period 1998 through 2001 in the US, \$1,992 billion was spent on acquisitions, which was four times what was spent from

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<sup>6</sup>Their underlying theoretical argument is that such flips are in the very nature of crisis-time FDI because foreign acquisitions take place during a liquidity crisis which normally would not have: domestic firms would have outbid foreign firms at normal times, being more natural users of domestic assets.

<sup>7</sup>In a regression of acquiring-firm abnormal returns on a crisis dummy which takes a value of 1 if the announcement date of the deal was either 3 months before or 9 months after the onset of a currency crisis in a particular country, they find the coefficient on the dummy to be insignificant. They favor a cost of capital view of the high abnormal returns they find. Their regression of returns on sovereign bond spreads, which are a proxy for the cost of financing projects in emerging markets faced by emerging market firms, gives a positive coefficient, suggesting that the larger the differential between the cost of capital of the developed market acquiring-firm and its target, the higher the gains anticipated by the stock market from the merger. However, in similar regressions with dollar value gain as the dependent variable the bond spread coefficients are not significant.

1980 through 1990, and these four years also saw a doubling in the number of MA. Thus the surge of FDI into emerging markets documented in Aguiar and Gopinath (2005) and Acharya et al. (2007) may have been part of a larger worldwide trend. Furthermore, it should be remembered that the crisis period were also a period of radical deregulation to ownership rules in the crisis-stricken countries in response to IMF strictures. Andrade et al. (2001) while noting the overwhelming importance of deregulation in driving industry-level MA activity cite the example of the 90s merger wave in the US. The financial sector in the crisis countries were among the first to be opened up to foreign ownership. It would not be surprising if this led to a surge of large investments in this industry, as documented by Acharya et al. (2007). Since a very large number of MA transactions occurred outside this sector, it would be worthwhile to know if flipping is omnipresent, or a peculiarity of the financial sector. This might be the case because of the presence of private equity firms which specialize in taking over a troubled concern, implementing value improving changes to it, and then selling it back at a profit to a more natural user of the asset, for instance a firm in the same industry. Thus, it would be interesting to learn if indeed the surge of FDI, and the associated flipping, was fire-sale FDI or business-as-usual.

### **2.2.2 What do we know about the longevity of foreign acquisitions?**

The extensive literature on divestitures has examined the causes, longevity and valuation effects of divestitures, both foreign and domestic. Theoretical research on divestiture has generally adopted performance, agency theory and asymmetric information perspectives, suggesting that the divestiture decision is determined by economic performance, governance effectiveness and the desire to improve firm market value by mitigating the valuation problems associated with diversified firms.

A number of papers, for example Bergh (1997), Kaplan and Weisbach (1992) and Ravenscraft and Scherer (1991), show that a large proportion of acquired businesses

is later divested. Kaplan and Weisbach (1992) studies a sample of large domestic acquisitions completed in the US between 1971 and 1982. By the end of 1989, acquiring-firms had divested almost 44 percent of the target companies. Ravenscraft and Scherer (1991) cites five common reasons that have been quoted in the literature as a cause of divestitures. These are, sub-par performance of divested units, financial difficulties faced by the divesting firm, lack of strategic fit between lines of business, low managerial attachment to the divested unit, and difficulties with the divested unit that had their roots in a previous merger. On a more aggregate level, learning and externalities have also been found to play a role. For example, Shaver et al. (1997) argue that foreign firms operating in a host country generate information spill-overs that have potential value for later FDI. They look at 354 U.S. investments undertaken by foreign firms in manufacturing industries during 1987 and track their survival to 1992. They find FDIs by firms with experience in a host country to be more likely to survive than investments made by first-time entrant, and greater survival chances the greater the foreign presence in the target industry at the time of investment, subject to two contingencies. The first contingency being that the relationship is weak or nonexistent among firms with no experience in the host country, probably because these firms have difficulty evaluating and taking advantage of the information spill-overs; the second, that the presence of other foreign firms does not affect investment survival among firms that already have a presence in the target industry and undertake expansion, presumably because they already possess general information about the target industries and are unlikely to gain additional benefit from information spill-overs. One of the few studies looking at emerging market divestitures is Holan and Toulan (2006) who look at divestitures by foreign companies in Argentina in the period 1990-2002. They find that macroeconomic factors as well as the structure of the original deal affect the longevity of the acquisition. To the best of our knowledge, our study will be the first to evaluate emerging market divestitures in a large set of

countries.

## 2.3 Some empirical facts

In this section we present some empirical facts regarding MA activity in a group of Asian countries during the period 1990-2008. The aim is to illustrate certain distinctive characteristics of FDI in the countries that were affected most by the crisis of 1997-1998. The following sections describe the data, the econometric techniques employed, and our main findings.

### 2.3.1 The data

We study the subset of firms that were involved in MA transactions in emerging economies in the period January 1990 to March 2009. Our data is collected from the SDC emerging market MA database.<sup>8</sup> Out of these, we identify firms that are mentioned as targets of MA more than once during the period in question. If a target is not mentioned multiple times in our data, it could mean three things: it never became a target again; it could not become a target again because at some subsequent point in time, it went out of business; it was reorganized by the first buyer under a different name and thus does not show up as a target under the same name. Firms that were not acquired during our sample period obviously do not enter the data, but might have been targets at some previous date. On the seller side, each listed acquisition in SDC could have been completed by a purchase of blocks from one or more sellers, or by stock-market purchases, or conversions of debt to equity by a financial institution. On the buyer side, most of the transactions involved a single buyer, though there are cases where the same firm is listed as a target on

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<sup>8</sup>Cross-border mergers occur when the assets and operation of firms from different countries are combined to establish a new legal identity, and cross-border acquisitions occur when the control of assets and operations is transferred from a local to a foreign company, with the former becoming an affiliate of the latter.

the same date multiple times, which indicates that multiple buyers were involved. This distinction is important in certain parts of the analysis, and will be addressed in a later section. SDC also lists the identity of the acquiring and target party, and various other deal characteristics, for example the percentage of the firm owned after the transaction is completed by the acquiring party, the dollar value of the deal, the industry characteristics of the target and acquiring firm, and so on.<sup>9</sup>

### **2.3.2 Patterns of Asian MA during 1990-2008**

This section provides an aggregate view of the developments in the market for corporate control in Asia during the years 1990-2008. Our analysis covers eleven Asian countries: China, Hong Kong, India, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand, and Vietnam. We focus on the evolution of the total number of MA transactions in these countries and three broad categories that are relevant to our story: transactions involving foreign buyers, those involving the financial sector, and those involving firms in the same one digit SIC industry.

Diagram (1) in appendix B.1 shows, for the eleven countries over the period 1990 to 2008, the total number of MA transactions and the numbers in three categories (foreign acquiring firm, financial acquiring firm, same SIC digit acquisitions). Diagram (2) shows the same information as percentages of total transactions. The total number of transactions as well as the numbers in each of the three categories trended upwards during the entire period. However, the percentage of transactions involving foreign buyers declined over this period.

We then classify the countries in our analysis into “high”, “medium”, and “low” crisis countries based on the economic indices reported in Goldstein (1998). Our

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<sup>9</sup>Where SDC does not list the parties involved in the transaction, we find financial-press articles from Dow Jones Factiva indicating who the sellers were in each of these acquisitions, wherever available. So for the (large) subset of acquisitions which were a result of divestitures by a seller, and whenever there is data, we find the identity of the divesting party. A concern with this method is that deals which receive press coverage might have characteristics systematically different from deals which do not.

“high” crisis countries are Indonesia, South Korea, and Thailand, the “middle” crisis countries are Hong Kong, Malaysia and Philippines, while our “low” crisis countries are China, India, Singapore, Taiwan, and Vietnam. The foreign versus domestic acquiring firm components of the total transactions shows an interesting pattern which is captured by the correlation table below. In the “high” crisis group, the correlation between the number of foreign transactions and (a) the total number transactions, (b) the number of domestic transactions, is much lower than in the other two groups of countries. This is driven by the fact that though the number of foreign and domestic transactions by and large moved together in the sample, they moved in opposite directions after 1998 in two of the “high” crisis countries, Thailand and South Korea. The correlations between the number of domestic and foreign transactions before and after 1998 for South Korea and Thailand changed sign from 0.8787 and 0.6101 to -0.4611 and -0.7232 respectively.<sup>10</sup> In the years after 1998 the number of transactions involving foreign buyers declined, offset by an increase in the number of transactions involving domestic buyers. This provides evidence suggestive of the kind of “flipping” noted in Acharya et al. (2009) and lends credence to a fire sale view of FDI during the crisis, especially in Thailand and South Korea. To explore this phenomenon more thoroughly, we next turn to an analysis of the longevity of mergers conducted during the crisis.

### **2.3.3 Stylized facts about longevity**

#### **2.3.3.1 Motivation for hazard analysis**

The econometric technique that we employ for our analysis is hazard or survival analysis. Survival analysis encompasses a set of risk-estimation techniques, originally developed for and employed in the analysis of event times in manufacturing processes and patient histories in medical trails, that are particularly suitable to the data and

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<sup>10</sup>Only one other country, Taiwan, shows this pattern of “flipping” post-1998.

	Foreign (crisis)	Domestic (crisis)
Total (crisis)	0.5158	0.9675
Foreign (crisis)	1	0.2823
Domestic (crisis)	0.2823	1
	Foreign	Domestic
Total	0.9341	0.9900
Foreign	1	0.8745
Domestic	0.8745	1

Table 2.1: Correlation between number of total, foreign, and domestic transactions (1990-2008)

question we have in mind. Simpler techniques, such as dummy variable analysis of events such as acquisitions have shortcomings because of their assumptions of a Gaussian error term in the data generating process. Consider the simple linear model,

$$t_j = \beta_0 + \beta' x_j + \epsilon_j, \quad \epsilon_j \sim N(0, \sigma^2)$$

where  $t_j$  is the time between a pair of acquisitions for target  $j$ , and  $x_j$  is vector of explanatory variables. This model assumes that

$$t_j | x_j \sim N(\beta_0 + \beta' x_j, \sigma^2)$$

whereas, event-times rarely follow the normal distribution, and are typically non-symmetric and even bi-modal. This non-normality of the distribution of event times is the primary motivation for using hazard analysis.

### 2.3.3.2 Structuring the data

Recall that the purpose of the study is to find whether acquisitions during crises are different, and whether there are further differences between groups such as trans-

actions involving domestic versus foreign acquiring firms, or same-industry versus different-industry pairings of target and acquiring firm. Unfortunately, in most cases SDC does not provide us with the identity of the seller in a transaction. Thus it is not possible, using the SDC data alone, to look at specific target-acquiring firm relationships, and track the time to their dissolution, because this would involve knowing the divesting party in each transaction. So we choose to look at whether times between subsequent acquisitions on average were any different for the subset of firms that were acquired during crises. This does not require knowing the identity of the divesting firm in each transaction. The definitions of the ‘subject’ that experiences the hazard of the event, the ‘failure-event’ itself, and the corresponding ‘failure-time’ depend on this distinction. We implicitly purport that firms that become targets during crises (rather than crisis-time acquisitions) are different in some way, and that this difference would show up starkly in an analysis that focusses on the experience of the targets over time. In this case, our subject is an isolated target firm, the failure event for a subject is simply a transaction involving that subject as a target, and the data is characterized by possible multiple events associated with the same firm, because the same firm might become a target multiple times.<sup>11</sup>

Although this approach admittedly simplifies the reality of the MA process, we can get a surprising amount of insight from this analysis. For example, we can correlate the average longevity of deals with certain observed characteristics of the transaction, like whether pairings between firms where the buyer was foreign firm were less likely to last on average. We also conduct robustness tests by conducting our analysis for different subsets of firms in which different ownership stakes were acquired. For instance, in cases where a target firm was fully acquired, there is no doubt as to the identity of the seller in the subsequent transaction involving the same target.

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<sup>11</sup>Because we cannot assume that event times are uncorrelated for the same firm, we cannot treat each event date as coming from a separate subject under study. Hence, our estimators and statistical tests have to take into account the possibility of this serial correlation.

### 2.3.3.3 Notation

We define ‘failure’ involving firm  $j$  simply as a transaction in which firm  $j$  was a target. The starting time for the risk of failure is defined to be the moment at which the previous MA transaction between  $j$ , and any acquiring firm, is completed. Then  $T_j$ , the failure-time, is just the duration of time which elapses between two consecutive transactions involving firm  $j$  as target.  $F$ , the cumulative density,  $S$ , the survivor function,  $f$ , the probability density, and  $h$ , the hazard function are then simply,

$$F(t_j) = \Pr(T_j \leq t_j) \quad (2.1)$$

$$S(t_j) = 1 - F(t_j) = \Pr(T_j > t_j) \quad (2.2)$$

$$f(t_j) = \frac{dF(t_j)}{dt_j} = \frac{d(1 - S(t_j))}{dt_j} = -S'(t_j) \quad (2.3)$$

$$h(t_j) = \lim_{\Delta t_j \rightarrow 0} \Pr(t_j + \Delta t_j > T_j > t_j | T_j > t_j) = \frac{f(t_j)}{S(t_j)} \quad (2.4)$$

The hazard function  $h(t_j)$  then gives us the probability that firm  $j$  will experience an acquisition event in the interval of time  $\Delta t_j$ , conditional on the fact that it has not been the target of an acquisition for  $t_j$  units of time since the last acquisition was completed. This hazard function captures the risk of a typical member of the population being acquired  $t$  days after its last acquisition. Under the plausible assumption that most acquisitions on the buyer side involve a divestiture on the seller side, this hazard is also a good measure of the typical frequency of divestiture for the average firm.

### 2.3.3.4 Semi-parametric Cox model

We pool the survival time data from the eleven Asian countries and analyze it using the Cox proportional hazards model (see Cleves et al. (2008)). The Cox model is semi-parametric. The key assumption is that hazard rates are proportional to

some baseline hazard across different patterns of explanatory variables. While the model assumes no parametric form for the the baseline hazard, it posits a functional relationship between hazards for different explanatory variables. Let the  $h(t)$  be the hazard function as defined before. Then the Cox model can be written as

$$h(t|X) = h_0(t)e^{X'\beta} \quad (2.5)$$

where  $h_0$  is the baseline hazard and  $X$  is a vector of explanatory variables like country fixed effects. Equivalently, the Cox model can be written as

$$\ln[h(t|X)] = \ln[h_0(t)] + X'\beta \quad (2.6)$$

Thus the sign of the estimated coefficients of the model can be interpreted as determining the direction in which the explanatory variables shift the natural logarithm of the baseline hazard. For example, estimating a Cox model with country dummies and the baseline hazard of Taiwan gives positive and significant  $\beta$  coefficients on each of the dummies, which can be interpreted as saying that Taiwan had the lowest divestiture probability in our sample of countries at each point in time (the results are reported in appendix B.1). The table shows that the hazard of divestiture was highest in Philippines, followed by Thailand, South Korea, Indonesia, Malaysia, Singapore, Hong Kong, India, China, Vietnam, and Taiwan.

Our main results are from a Cox model with a complete set of controls. In this regression we control for (i) unobserved country characteristics using country dummies; (ii) the acquiring firm being foreign or domestic; (iii) the acquiring firm being from the financial or non-financial sector; (iv) the transactions being between firms in the same sector; (v) an indicator variable for the years 1997-1998; and (vi) interaction dummies between (i), (v), and each of (ii), (iii), and (iv).<sup>12</sup>

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<sup>12</sup>An example of (vi) would be a dummy for transactions (i) in Indonesia, (v) during the 1997-1998 crisis, (ii) by foreign buyers.

Table B.2 of appendix B.1 presents a subset of coefficients from this regression. We report dummy coefficients for foreign acquisitions in South Korea and Singapore as representative of two extremes of crisis severity. The table shows that hazard rates were significantly higher in South Korea than in Singapore when the acquiring firm was a foreign firm, and that the rate was actually *lower* than the baseline (Taiwan) for foreign acquisitions overall. The complete set of coefficients (not reported) reveal that hazard rates were significantly higher than the baseline in the “high” crisis countries when the target and acquiring firm were from different one digit SIC sectors; and significantly higher than the baseline for financial acquiring firms overall.

In summary, the data suggest that crisis-time pairings were less likely to last. The facts discussed above suggest a number of possible reasons. First, crisis-time buyers were predominantly foreign. Secondly, pairings took place where acquiring firms were from the financial sector and were thus less likely to hold a controlling interest for very long. A third reason is that pairings between firms from different industries increased during the crisis. The data also indicates that being acquired by a foreign firm during in the countries with a severe crisis meant that you were more likely to be sold later on, and possibly “flipped” to a domestic buyer. Motivated by these broad stylized facts, we build a simple model of MA in the following section.

### **2.3.3.5 Robustness checks**

Three robustness checks are conducted to check the above results. First, we check if the results hold for the small subset of transactions that involved a complete (100%) transfer of control. Due to the consequent large reduction in sample size, we replace the individual country dummies in the previous analysis with a dummy for “high” crisis countries (Thailand, Indonesia, South Korea). The results, reported in the appendix, remain qualitatively unchanged.

Next, we take into account the fact that major policy changes regarding capital

movement and foreign investment were implemented during the crisis. Most of the literature to date has compared the pre-crisis period to the crisis-period, ignoring these regime shifts. Hence, we exclude the pre-crisis transactions from the analysis, comparing only the years 1997-1998 to the 1999-2008 period. Unsurprisingly, the results (not reported) remain unchanged: since the volume of MA increased substantially after the crisis deregulations, the weight of the 1999-2008 transactions is disproportionately high in the results of the previous section using the entire sample.

We also include transactions from a set of non-Asian countries as a control group. These countries are Argentina, Brazil, Chile, Egypt, Mexico, Morocco, Peru, and South Africa. We then repeat the analysis of the previous section. The results for our group of Asian countries remain qualitatively unchanged. As before, selective results are reported in the appendix contrasting South Korea and Singapore.

## 2.4 The model

This section presents a simple dynamic model of search and matching between acquiring and target firms by extending the Diamond-Mortensen-Pissarides (Diamond (1993), Mortensen and Pissarides (1994)) framework of job search in the spirit of Rhodes-Kropf and Robinson (2008). The problem is cast as a two-sided matching problem in continuous time and follows closely the treatment in Pissarides (2000). Even though mergers and acquisitions are each distinct activities, we abstract from any differences and describe both of them as a matching process.

### 2.4.1 The environment

**Firms:** The model consists of a small open economy  $S$  and the rest of the world  $W$ . There are a pool of target firms in  $S$ , numbering  $N$ .  $N$  is a large number determined exogenously by macroeconomic conditions. Out of these  $N_A$  are of type  $A$  and  $N_B$  are of type  $B$ . “Type” can be interpreted narrowly as industry, or broadly

as any characteristic of a firm that may be relevant for the purposes of matching. The ratio  $\frac{N_A}{N_B}$  is exogenous. At any point in time,  $uN$  of these firms are actively looking to sell assets, the same fraction  $u$  of each type. There are also acquiring firms, *distinct* from the target firms and all of type  $A$ , that are looking to buy assets. Their number, expressed in terms of  $N$  is  $vN$ . Out of these,  $v_S N$  are from  $S$  and  $v_W N$  are from the rest of the world.  $v(= v_S + v_W)$  and  $u$  are determined in the model, while  $\frac{v_S}{v_W}$ , the relative proportion of domestic acquiring firms, is exogenous and determined by macroeconomic conditions. For the moment we will assume that foreign and domestic acquiring firms are identical in all respects except that they are labeled differently.

The number of matches taking place per unit time is given by

$$mN = m(uN, vN), \quad (2.7)$$

which is the matching function. It is assumed to be increasing in both its arguments, concave, and homogeneous of degree 1. The acquiring and target firms that are matched at any point in time are randomly selected from the sets  $vN$  and  $uN$ . Hence the process that changes the state of acquiring firms is Poisson with rate  $\frac{m(uN, vN)}{vN}$ . Denoting  $\frac{v}{u}$  as  $\theta$ , the rate at which acquiring firms match with targets can be written as

$$q(\theta) \equiv m\left(\frac{u}{v}, 1\right) \quad (2.8)$$

by the degree 1 homogeneity of the matching function.

**Productivity:** A firm of type  $A$  or  $B$  is a Lucas Tree whose output is  $z_A$  or  $z_B$ , which also denotes the stand-alone productivity of a firm of a particular type. Firms of each type, though clearly labeled and known to be as such, are indistinguishable by productivity in their unmatched state. Thus  $z_A = z_B = z$ . Only when they match, do their type begin to matter in a way described below. Henceforth, we will use the general notation  $z_A$  or  $z_B$  with the implicit understanding that they are equal

in value. Merger-specific (idiosyncratic) shocks to the productivity of a match arrive at the Poisson rate  $\lambda$ . Once a shock arrives, an acquiring party can choose either to continue the match with the new productivity, or terminate the match and divest. As a simplification, we assume that the productivity of the match can take two values: it is either high enough so that continuing the relationship is profitable, or low enough so that divestiture results. Idiosyncratic shocks move the value of productivity from the high level to the low one at rate  $\lambda$ .

The high-state productivity of a match depends on the type of the two matching firms. Define a function  $z^h = z(z_i, z_j)$  with  $i = A$  and  $j = A, B$  that gives the high-state productivity of a match between acquiring firm  $i$  and target firm  $j$ . Thus,  $z^h(z_A, z_B)$  is the high-state productivity of the matched entity when acquiring firm of type  $A$  and target of type  $B$  match, and  $z^h(z_A, z_A)$  the productivity of the matched entity when acquiring firm of type  $A$  and target of type  $A$ . Similarly, we denote the low-state match productivity values as  $z^l(z_A, z_B)$  and  $z^l(z_A, z_A)$ . We assume that

$$\begin{aligned} z_A + z_B &< z^h(z_A, z_B) < z^h(z_A, z_A) \\ z^l(z_A, z_B) &< z^l(z_A, z_A) < z_A + z_B \end{aligned} \tag{2.9}$$

The first inequality on the first line expresses the idea that MA create value if match productivity is in the high state and the second inequality says that greater value is created when similar types match.<sup>13</sup> As noted before, “type” can be interpreted quite broadly in this context. A good match may result from the combination of complementary assets of firms in the same industry. For example, a foreign bank may match with a domestic bank to take advantage of its existing local client base. Or, the gains from a match may result from industry-specific expertise. The inequalities

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<sup>13</sup>The first assumption is a simple way to introduce incentives for matches. It is controversial given the large literature on the destruction of value by MA, see for example Moeller et al. (2005). However, Chari et al. (2007) find that MA create value when targets are from emerging markets and acquiring firms from developed markets, which is the situation we model.

on the second line simply state that mergers destroy value in the low state, and hence will not be undertaken in equilibrium. The value of the high-state productivity itself is not subject to uncertainty, though it may switch to the low-state productivity by the stochastic process described before.

**Mergers/Acquisitions:** MA are modeled in a simple way. A match takes place between an acquiring and target firm when they meet and agree to merge. Once a merger takes place, production continues at the high productivity till a negative shock hits. At this point a divestiture occurs. The separating target and acquiring firm rejoin the pool of unmatched target firms and acquiring firms respectively. In addition, the acquiring firm can choose to withdraw from the market for corporate control.

Without growth in the number of firms, the mean number of target firms which are divested during a small time interval  $\delta t$  is  $\lambda(1 - u)N\delta t$ , and the mean number of target firms which match with acquiring firms is  $mN\delta t$ . The latter can be rewritten as  $u\theta q(\theta)\delta t$ . The evolution of the mean number of firms that are seeking buyers is then the difference between these two rates,

$$\dot{u} = \lambda(1 - u) - \theta q(\theta)u. \quad (2.10)$$

In the steady state, the mean number of firms seeking acquiring firms is constant, so

$$\lambda(1 - u) = \theta q(\theta)u. \quad (2.11)$$

Lemma 1 rewrites  $u$  in terms of the rate of dissolution of mergers  $\lambda$  and the rate of formation of matches  $\theta q(\theta)$ .

**Lemma 1.** *The fraction  $u$  of unmatched target firms looking to find acquiring firms*

is

$$u = \frac{\lambda}{\lambda + \theta q(\theta)}. \quad (2.12)$$

This is the first key equation of the model. It implies that for given  $\lambda$  and  $\theta$ , there is a unique equilibrium number of unmatched firms.  $\lambda$  is a parameter of the model;  $\theta$  is an unknown. It is shown next that  $\theta$  is determined by an equation derived from the assumption of profit maximization and that it is unique and independent of  $u$ .

**Acquiring firm:** A match takes place when a prospective *unmatched* acquiring firm and a prospective *unmatched* target meet and agree on the terms of the match. Before this happens, both an acquiring firm and a target firm have to be unmatched and searching. The contract at the time of matching specifies a distribution of the surplus from the match. Only a pair of firms may match. As described before, the value of the output from a match is  $z^h(z_A, z_A)$  or  $z^h(z_A, z_B)$ . At times when a match has not yet taken place, the acquiring firm searches for a target at a fixed cost of  $cz^h > 0$  per unit time. During this process, targets arrive to acquiring firms at the rate  $q(\theta)$ , which is independent of the actions of the acquiring firm. The search cost is made proportional to the match productivity to capture the idea that it is costlier to find a better match. The number of acquiring firms searching for a target is endogenous and determined by profit maximization. Since any firm is free to search for a target, profit maximization requires that a zero profit condition hold for the entry of acquiring firms into the market for corporate control.

Let  $J_{AA}$  and  $J_{AB}$  be the present-discounted value of the expected profit to an acquiring firm from a matched situation with target type  $A$  and  $B$  respectively;  $V_A$  is the present-discounted value of expected profit to an acquiring firm from being in an unmatched state. With perfect capital markets, an infinite horizon and when no

dynamic changes in parameters are expected,  $V_A$  satisfies the Bellman equations

$$\begin{aligned} rV_A &= z_A - cz^h(z_A, z_A) + q(\theta)(J_{AA} - V) \\ rV_A &= z_A - cz^h(z_A, z_B) + q(\theta)(J_{AB} - V) \end{aligned} \quad (2.13)$$

Since in equilibrium all profit opportunities from new matches are exploited, rents from the state unmatched for acquiring firms is driven to zero. This gives Lemma 2.

**Lemma 2.** *Since  $V_A = 0$  in equilibrium*

$$\begin{aligned} J_{AA} &= \frac{cz^h(z_A, z_A) - z_A}{q(\theta)} \\ J_{AB} &= \frac{cz^h(z_A, z_B) - z_A}{q(\theta)}. \end{aligned} \quad (2.14)$$

This is the second set of key equations of the equilibrium model. For an individual firm,  $\frac{1}{q(\theta)}$  is the expected duration of being unmatched. The above conditions state that in equilibrium, *market tightness*  $\theta$  is such that the expected profit from a new match is equal to the expected cost of matching. Since in the environment of the model a firm cannot enter the market for corporate control while being matched, there are rents in equilibrium associated with the matched state. Competition for matching with an acquiring firm drives those rents down to the expected cost of finding a target.

The asset value of a matched situation satisfies a value equation similar the one for the unmatched situation. The flow capital cost of the matched situation is  $rJ_{AA}$  or  $rJ_{AB}$ . The match yields a net return of  $z^h(z_A, z_A) - T_{AA}$  or  $z^h(z_A, z_B) - T_{AB}$ , where  $z^h(z_A, z_A)$ ,  $z^h(z_A, z_B)$  are real output after matching and  $T_{AA}$ ,  $T_{AB}$  are the shares of the target firm in the surplus sharing arrangement specified in the contract of the match. The match also runs a risk  $\lambda$  of an adverse shock which leads to the loss of

$J$ . Hence  $J_{AA}$  and  $J_{AB}$  satisfy the conditions,

$$\begin{aligned} rJ_{AA} &= z^h(z_A, z_A) - T_{AA} - \lambda J_{AA} \\ rJ_{AB} &= z^h(z_A, z_B) - T_{AB} - \lambda J_{AB} \end{aligned} \quad (2.15)$$

The acquiring firm takes the interest rate and value of the match as given, but the surplus-sharing arrangement is determined by a bargain with the target. Using the previous two sets of equations to eliminate  $rJ_{AA}$  we get Lemma 3.

**Lemma 3.** *The “demand for mergers” conditions relating the surplus share of the target to the creation of matches are given by*

$$\begin{aligned} z^h(z_A, z_A) - T_{AA} - \frac{(r + \lambda)(cz^h(z_A, z_A) - z_A)}{q(\theta)} &= 0 \\ z^h(z_A, z_B) - T_{AB} - \frac{(r + \lambda)(cz^h(z_A, z_B) - z_A)}{q(\theta)} &= 0 \end{aligned} \quad (2.16)$$

**Target firm:** Let  $U_A$ ,  $W_A$  and  $U_B$ ,  $W_B$  denote the present-discounted value of the expected income stream of, respectively, an unmatched and matched target of types  $A$  and  $B$ . A target enjoys (expected) real return  $z_A$  or  $z_B$  (recall,  $z_A = z_B = z$ ) when unmatched, and in unit time expects to match with probability  $\theta q(\theta)$ . Hence  $U_A$ ,  $U_B$  satisfy

$$\begin{aligned} rU_A &= z + \theta q(\theta)(W_A - U_A) \\ rU_B &= z + \theta q(\theta)(W_B - U_B). \end{aligned} \quad (2.17)$$

Matched targets get  $T_{AA}$  or  $T_{AB}$  depending on their type; the match gets dissolved

with an exogenous probability  $\lambda$ . Hence,  $W_A$  and  $W_B$  satisfy

$$\begin{aligned} rW_A &= T_{AA} + \lambda(U_A - W_A) \\ rW_B &= T_{AB} + \lambda(U_B - W_B). \end{aligned} \tag{2.18}$$

The previous two sets of equations yield the flow value of matched and unmatched target firms as a weighted average of their matched and unmatched productivity  $z$  and  $T_{AA}, T_{AB}$ , where the weights are a function of the discount rate  $r$  and the transition rates  $\lambda, \theta q(\theta)$ .

$$\begin{aligned} rU_A &= \frac{(r + \lambda)z + \theta q(\theta)T_{AA}}{r + \lambda + \theta q(\theta)} \\ rU_B &= \frac{(r + \lambda)z + \theta q(\theta)T_{AB}}{r + \lambda + \theta q(\theta)} \end{aligned} \tag{2.19}$$

$$\begin{aligned} rW_A &= \frac{\lambda z + (r + \theta q(\theta))T_{AA}}{r + \lambda + \theta q(\theta)} \\ rW_B &= \frac{\lambda z + (r + \theta q(\theta))T_{AB}}{r + \lambda + \theta q(\theta)} \end{aligned} \tag{2.20}$$

Since  $T_{AB} \geq T_{AA} \geq z_A = z_B = z$ , it follows from the above four equations that matched firms of either type have higher value than unmatched firms. Hence, being in an unmatched state is more costly to those firms currently experiencing it than those which expect being in that state on the future. But in the absence of discounting, target firms in these two states are equally well off in flow value terms. The reason is that with an infinite horizon, all target firms eventually are involved equally in matches and divestitures, and the precise timing of the experience does not affect ex ante returns.

**Nash Bargaining:** As is standard in the search literature, we assume that the surplus sharing rules  $T_{AA}$  and  $T_{BB}$  are decided by the acquiring and target firms by

Nash bargaining (Nash (1953)). Thus  $T_{AA}$  and  $T_{BB}$  satisfy

$$T_{ij} = \arg \max (W_{ij} - U_{ij})^\beta (J_{ij} - V_{ij})^{1-\beta} \quad i = A \text{ and } j = A, B \quad (2.21)$$

where  $0 \leq \beta \leq 1$ .  $\beta$  captures the relative bargaining positions of the acquiring and target firm that are a functions of factors *other than* the “threat points” or outside options given by  $U_{ij}$  and  $V_{ij}$

The first-order maximization conditions satisfy

$$W_{ij} - U_{ij} = \beta (J_{ij} + W_{ij} - V_{ij} - U_{ij})^{1-\beta} \quad i = A \text{ and } j = A, B. \quad (2.22)$$

So  $\beta$  is the target firm’s share in the total surplus that a match creates. The standard solutions to the Nash bargaining problem for  $T_{AA}$  and  $T_{AB}$  are provided in Lemma 4.

**Lemma 4.** *Target firms of type A and B claim  $T_{AA}$  and  $T_{AB}$  of post-match output, given by*

$$T_{ij} = (1 - \beta)z + \beta z^h(z_i, z_j)(1 + c\theta) \quad i = A \text{ and } j = A, B. \quad (2.23)$$

Intuitively,  $z^h(z_i, z_j)c\theta$  is the average cost to the acquiring firm of merging with an unmatched target firm. Thus, targets are rewarded for the saving of the merging costs that the representative acquiring firm gains when a merger is completed. A higher  $\theta$  indicates that acquiring firms arrive to target firms at a higher rate than targets to acquiring firms, relative to an equilibrium with lower  $\theta$ . The target’s bargaining strength is then higher and the acquiring firm’s lower. As a result, the target ends up with a higher  $T_{ij}$  in the high  $\theta$  equilibrium.

#### 2.4.2 Steady-state equilibrium analysis

In this section we define and characterize the equilibrium of the model. We also develop some tools that will be used in the next section to relate the model to the

stylized facts.

**Definition 2.** *An equilibrium in the model is a set  $(u, \theta, T_{AA}, T_{AB})$  that satisfies the following conditions:*

(1) *The flow equilibrium condition from Lemma 1*

$$u = \frac{\lambda}{\lambda + \theta q(\theta)}$$

(2) *The demand for MA conditions from Lemma 3*

$$z^h(z_A, z_A) - T_{AA} - \frac{(r + \lambda)(cz^h(z_A, z_A) - z_A)}{q(\theta)} = 0$$

$$z^h(z_A, z_B) - T_{AB} - \frac{(r + \lambda)(cz^h(z_A, z_B) - z_A)}{q(\theta)} = 0$$

(3) *The target surplus shares from Lemma 4*

$$T_{AA} = (1 - \beta)z + \beta z^h(z_A, z_A)(1 + c\theta)$$

$$T_{AB} = (1 - \beta)z + \beta z^h(z_A, z_B)(1 + c\theta).$$

The equations from Lemmas 3 and 4 can be used to solve for the equilibrium  $\theta$ ,  $T_{AA}$  and  $T_{AB}$ . The following figure plots the “demand for MA” curves and the “target surplus shares” conditions. The equilibrium values of  $\theta$ ,  $T_{AA}$  and  $T_{AB}$  can be found from their intersection. Higher match productivity leads both curves to be higher for type A. But with  $\beta < 1$ , higher match productivity leads to a greater shift up of the “demand for MA conditions” than the surplus sharing arrangement. This gives us the following proposition.

**Proposition 3.** *Market tightness and target’s share of surplus are larger for type A targets, i.e.  $T_{AA} > T_{AB}$  and  $\theta_{AA} > \theta_{AB}$ .*

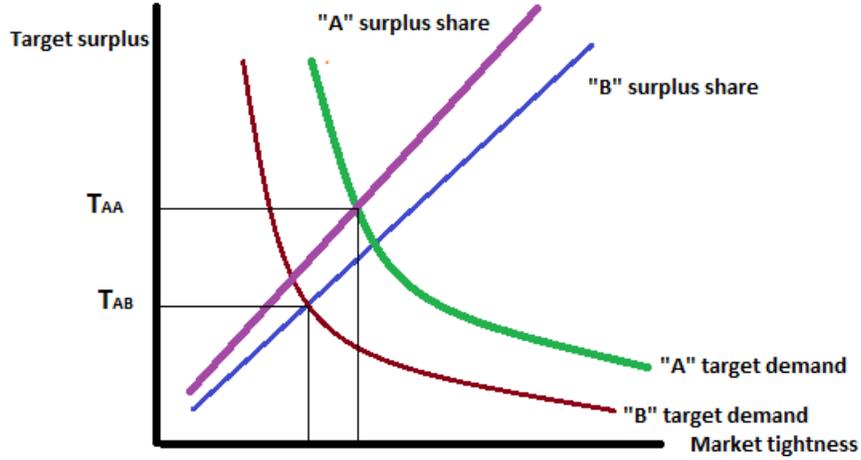


Figure 2.1: Determination of equilibrium target shares ( $T_{AA}$  and  $T_{AB}$ ) of surplus and market tightness ( $\theta$ )

**Proof:** This follows upon inspection of the expressions for the two equilibrium conditions for each type and from  $\beta < 1$ .

The result is intuitive. Type A target firms have higher bargaining power because matching with them creates greater total surplus. The value of  $\theta = \frac{v}{u}$  is also higher for type A targets. This is because there are relatively more acquiring firms looking for a match with type As than for type Bs, as well as relatively few unmatched type As looking for matches.<sup>14</sup> This can be seen using another convenient diagrammatic tool, the “flow equilibrium condition” from Lemma 1 and the equilibrium  $\theta = \frac{v}{u}$  from the previous diagram, plotted together. The former is a negatively sloped curve on  $u - v$  plane while the latter is a line with constant slope equal to the equilibrium  $\theta$ .

## 2.5 Mergers and acquisitions during financial crises

This section uses the framework developed to analyze the effects of a financial crisis, which is modeled in a very simplistic way. As noted by Aguiar and Gopinath

<sup>14</sup>In equilibrium, acquiring firm search for both types because they would rather match with any type than not match at all.

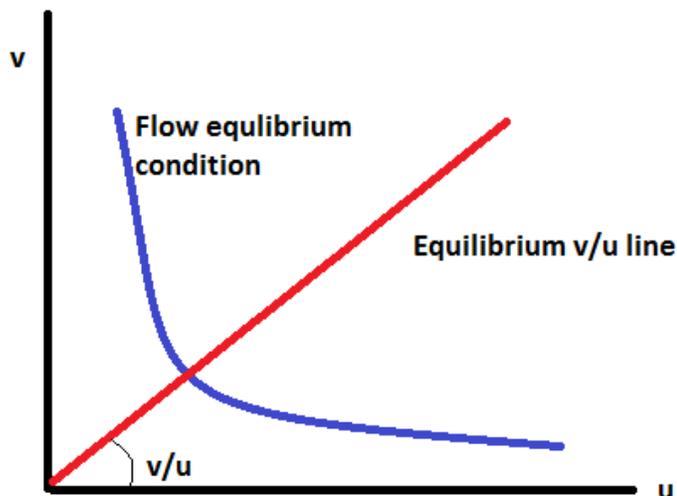


Figure 2.2: Determination of equilibrium fraction of unmatched targets ( $u$ ) and acquiring firms looking for targets ( $v$ )

(2005), the Asian financial crisis was accompanied by a sharp decline of domestic liquidity in the affected countries. Leveraged domestic firms found themselves unable to make payments on short-term debt or failed to convince financial markets to roll their debt over due to worsening revenue streams. As a result, they found themselves in an unfavorable bargaining position vis-à-vis acquiring firms to whom they were looking to sell assets. In terms of our model, the situation is characterized below.

**Definition 3.** *A financial crisis in the market for corporate control is an exogenous decline in the bargaining power ( $\beta$ ) of target firms.*

An unexpected change in the model parameter  $\beta$  leads to a dynamic adjustment to a new equilibrium. For the moment, we abstract from these dynamics and focus on particular characteristics of the new steady-state with a lower  $\beta$ .

**Proposition 4.** *During a financial crisis when  $\beta$  is lower,*

(1)  *$\theta$  is higher for both types,  $v$  is higher for both types, and  $u$  is lower for both types.*

(2) *Relatively more matches of lower match quality, i.e. between type A acquiring firms and type B targets take place during a financial crisis.*

(3) The surplus shares,  $T_{AA}, T_{AB}$ , for both target types is lower.

**Proof:** (1) and (3) follow from the diagrams. A decline in  $\beta$  shifts only the “surplus share” curves down, reduces both  $T_{AA}$  and  $T_{AB}$ , and increases  $\theta$  for both types. That  $v$  is higher for both types, and  $u$  is lower for both types can be seen by tilting the equilibrium  $\theta = \frac{v}{u}$  line up to the new, higher  $\theta$ .

(2) Solving analytically for  $\theta$  and differentiating we can show that

$$\frac{d\theta}{d\beta} = \frac{z^h(i, j)(1 + c\theta) - z}{z^h(i, j)\left(\frac{(r+\lambda)cq'(\theta)}{q^2(\theta)} - c\beta\right)} < 0$$

and

$$\frac{d^2\theta}{dz^h d\beta} < 0,$$

which implies that when  $\beta$  declines, market tightness  $\theta = \frac{v}{u}$  increases by less for type  $A$  firms and then for type  $B$  firms.

**Corollary 1.** *Matches taking place during crises will dissolve with higher probability.*

**Proof:** When the change in  $\beta$  is reversed, market tightness will decline by more for the type  $B$  firms and then for type  $A$  firms. The result follows from this observation.

Thus, the model is able to qualitatively replicate the stylized facts that we started out with: that during the “crisis” versus “other times” (low  $\beta$  versus high  $\beta$  state), relatively more pairings between firms from different SIC sectors took place, and that acquisitions by foreign financial firms or firms from different SIC-digit industries than their targets were less likely to last if conducted during the crisis. Recall, that we interpret matches between foreign and domestic firms, and firms from different SIC sectors as lower quality matches.<sup>15</sup> Since the  $A - B$  pairings were seen to be more

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<sup>15</sup>The reasoning behind this comes from the existence of complementary or sector-specific assets.

sensitive to changes in  $\beta$  than the  $A - A$  pairings, the model predicts the correct pattern of MA activity during the crisis, and the correct pattern of divestiture post-crisis.

## 2.6 Discussion and conclusion

This paper asks if mergers and acquisitions that took place in affected countries during the Asian financial crisis of 1997-1998 were substantively different in terms of their survival rates. To answer this question, we construct a comprehensive survival-time data set of MA in a group of Asian countries covering the period 1990-2008 using the Securities Data Company database. Using parametric and non-parametric survival-analysis techniques, we find that the survival-times of foreign acquisitions in crisis-hit countries (versus countries less affected by the crisis) were shorter than domestic ones, and that pairings between firms from different SIC sectors, and acquisitions by foreign financial firms were less likely to last if conducted during the crisis. We also construct a simple model of mergers as a matching process between firms by extending the classic Diamond-Mortensen-Pissarides framework to the problem of an acquiring firm searching for a target. The model is able to replicate some qualitative features of the data, like the matching of unlike firms during the crisis and the early dissolution of such mergers afterwards. The mechanism works through an increase in the incentives of acquiring firms to search for targets due to the lower bargaining power of the latter during financial crises, and the consequent externality for target firms.

FDI is generally thought of as a long term capital flow that is beneficial to the recipient country. But the recent trend of FDI completed through purchase of existing assets by the MA process goes contrary to this view because of the relative ease of subsequent divestiture. This paper presents some preliminary evidence that this might be especially true for fire-sale FDI conducted during financial crises.

The work in this paper may be enriched along several dimensions. A more complete parametric investigation of survival times with firm-level independent variables will tell us which firm characteristics determine divestitures. The asset pricing implications of these divestitures could also be explored using an event-study methodology centered around the announcement date of the acquisition and subsequent divestiture. Abnormal returns in the event-window of the subset of publicly traded firms in our sample would contain information on how financial markets price the quality of matches taking place during crises. The simple theoretical model presented could also be extended to include capital accumulation, endogenous determination of the roles of target versus acquiring firm, and an explicit role of liquidity. Addressing these questions is left for future work.

## CHAPTER III

# The Aggregate Consequences of Imperfect Institutions

### 3.1 Introduction

This paper examines the relationship between four key macroeconomic variables and the quality of economic institutions in a country. It is shown that countries with stronger domestic institutions (i) have smaller average firm sizes and a more positively skewed firm size distribution (FSD henceforth) overall,<sup>1</sup> while having a higher proportion of large firms when taking into account only the upper tail of the FSD; (ii) exhibit lower macroeconomic volatility, measured by the standard deviation of the growth rates of gross domestic product (GDP) and consumption; (iii) use more market finance, measured by the number of listed companies and market capitalization as a percentage of GDP; and (iv) have lower domestic risk premia.

Using yearly data from the WorldBank (2008), Kaufmann et al. (2008), and Chinn and Ito (2008), we create a cross sectional data set comprising various country-level measures of aggregate volatility, financing costs, and market finance prevalence, along with country controls.<sup>2</sup> We also create an industry-country panel of estimated mo-

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<sup>1</sup>Positive skewness means a higher proportion of smaller firms in the FSD.

<sup>2</sup>We do not employ a panel because there is not much time variation in our primary independent variable, institutional quality. Also, we need to make use of the time dimension of the data to calculate our measures of aggregate volatility.

ments and parameters of firm size distributions using annual sales and employment data from ORBIS. Following Desai et al. (2003), we then run multivariate regressions with country and industry controls to examine the effect of institutional quality on our variables of interest.

Firm-level and aggregate facts are usually treated separately in the literature. For example, Kumar et al. (1999), Cooley and Quadrini (2001), Cabral and Mata (2003), Angelini and Generale (2008), Champonnois (2010), and Arellano et al. (2008) examine the effects of financial constraints and contract enforcement on FSD and firm dynamics. Others, such as Shleifer and Wolfenzon (2002), Cooley et al. (2004), and Albuquerque and Wang (2008) point out that weak contract enforcement go hand in hand with high aggregate volatility and intermediated financing costs. A unified empirical treatment of aggregate volatility and FSD has been missing because individual firms play no role traditional macroeconomics: in model economies made up of a continuum of identical small firms, firm-level volatility does not translate into aggregate volatility due to the law of large numbers. Yet, as discussed in Gabaix (2005), the distribution of firm sizes is heavy-tailed in reality, with a large number of small firms and a few very large firms. This creates a link between a country's FSD and its macroeconomic aggregates. Thus, factors that possibly affect FSD also have macroeconomic consequences. The primary contribution of our paper lies in correlating some facts about aggregate risk and FSD to the same country-level measure of institutional quality in a unified sample of countries.

The rest of the paper is organized as follows. Section 3.2 motivates our empirical approach and surveys the most relevant papers. Section 3.3 and its subsections describe the data, empirical specifications, and our main results. Section 3.4 concludes.

## 3.2 Related literature and theoretical motivation

Though the primary objective of this paper is to unearth stylized facts, we are not agnostic about the underlying mechanism which generates these facts. Specifically, we take the view that financial frictions created by the ownership structure of firms and weak institutional quality link all these facts together.

As noted by Champonnois (2008), FSD has been used as an ingredient in the explanation of a number of phenomenon in economics like exporting behavior (Helpman et al. (2004), di Giovanni and Levchenko (2009)), aggregate fluctuations (Gabaix (2005)), and the finance-growth relationship (Beck et al. (2008)). Yet the determinants of FSD, and how and why it varies across the world is not well understood. At the same time, the importance of financial constraints for firm investment has received much attention in the literature (see Desai et al. (2003) for a review). A branch of this research program (exemplified by Kumar et al. (1999), Cooley and Quadrini (2001), Cabral and Mata (2003), and Angelini and Generale (2008)) looks at the effects of financial constraints on FSD through the lens of partial equilibrium theoretical or empirical models. By contrast, our paper is motivated by general equilibrium considerations about the *origin* of these financial constraints: we contend that a common set of institutional determined frictions may be driving both the investment decisions of individual firms as well as the overall distribution of firm sizes, with financial constraints and FSD interacting in general equilibrium through a number of channel, among them, aggregate volatility and risk premia.

There are three crucial elements in this story: a fixed cost of market finance, which ensures that only firms beyond a certain cut-off productivity level can afford to go public, a variable cost (risk premium) for intermediated finance which is determined in equilibrium, and the presence of firm insiders.<sup>3</sup> Weak institutional quality

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<sup>3</sup>The first two elements of the environment are borrowed from the model of Champonnois (2010), who posits a cost structure of intermediated versus market finance without explicitly modeling the underlying frictions from which it arises.

raises the fixed cost of market finance leading to fewer publicly listed firms as well as lower stock market capitalization. It also worsens the conflict of interest between insider-managers and outside investors over the use of cash-flows, leading to suboptimal dividend policies. This creates a lack of investible resources in the economy, pushing up intermediated financing costs for firms that are not productive enough to pay the fixed cost of market finance. Inefficiencies in investment allocation are the outcome. Thus poor investor protection leads to a positively skewed distribution of firms, with a handful of public firms with inefficiently large capital stock, and a much larger multitude of inefficiently small firms starved of financing. At the same time, idiosyncratic shocks to the productivity of large firms cause the aggregate volatility of output and investment to be higher due to the factors noted in Gabaix (2005), leading to an additional feedback effect through the country risk premium.

The papers closest to ours are Champonnois (2008, 2010) and Desai et al. (2003) who identify a number of channels that determine FSD, like contract enforcement, product-market competition, goods substitutability, labor market flexibility, the risk tolerance of external investors, and entry costs. In their study on the determinants of FSD across the Central and East Europe (CEE) and Western Europe, Desai et al. (2003) find that both the overall level of skewness and the relative skewness of firm-size distributions for younger firms are a function of fairness and protection of property rights with particularly amplified effects in the CEE. They conclude that these results are consistent with capital constraints leading to skewness in firm-size distributions, with the relative importance of these factors being greater in emerging markets.

Champonnois (2010) constructs a structural model of a firm's decision to use intermediated versus market finance. Exploiting the variation in FSD across countries, he identifies the cost of market finance (relative to intermediated finance) using the model's prediction that industries with small firms will raise disproportionately more market finance (relative to intermediated finance) in countries with a lower relative

cost of market finance. Champonnois (2008), using firm-level data from 23 countries in Europe in 2003, finds in an industry-country panel that industry fixed effects explain three times more of the differences in firm size dispersion than country fixed effects.

### **3.3 Empirical analysis**

#### **3.3.1 Data sources**

The data source for FSD is ORBIS, which is a comprehensive database of companies from Bureau Van Dijk Electronic Publishing. ORBIS coverage varies sharply across countries. We use data for the years 2006 and 2007, the last two years for which our primary independent variable, the Kaufmann et al. (2008) measure of institutional quality, is available. The variables of interest are firm size measured by annual sales and number of employees. The data on risk premia, number of listed firms, stock market capitalization, gross investment, gross fixed investment, and GDP come from WorldBank (2008). Country-level controls such as GDP, per capita GDP, financial development, and trade openness are from the WorldBank (2008), and the index of financial openness is from Chinn and Ito (2008).

#### **3.3.2 Description of independent variables**

The quality of institutions is measured using the simple average of the six indices in Kaufmann et al. (2008) that quantify general governance, the degree of corruption, the rule of law, political stability, effectiveness of regulations, and voice (the strength of media and public opinion). Though these are indicators of general institutional quality and do not pertain directly to factors which affect the financing of firm, they are a natural choice for the analysis because they are available for 213 countries.<sup>4</sup>

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<sup>4</sup>Robustness checks are conducted with additional indices of institutional quality from LaPorta et al. (1998b) which measure rule of law, risk of contract repudiation by the government, risk of

Country controls are GDP in trillions of US dollars (USD) (size), per capita GDP in thousands of USD (level of development), trade as a percentage of GDP (trade openness), and domestic credit to the private sector as percentage of GDP (from the WorldBank (2008)), and the financial openness index from Chinn and Ito (2008).

### 3.3.3 Description of dependent variables

Macroeconomic volatility is measured by the standard deviation of the growth rates of GDP, consumption, gross capital formation, and gross fixed capital formation. Intermediated financing costs are measured by the domestic risk premium while the extent of market finance is measured by the number of listed firms and stock market capitalization.

We use two proxies for firm size, the logarithm of sales and employment, both denoted by  $s_{fij}$ . This data is available at the level of a firm  $f$  belonging to country  $i$  and industry  $j$ . Following Desai et al. (2003), the dependent variables in our regression analysis are the simple average and skewness of the sample of firm sizes in country  $i$  and industry  $j$ . The mean, denoted  $\text{mean}_{ij}$ , is calculated as

$$\text{mean}_{ij} = \frac{1}{N_{ij}} \sum_f s_{fij}$$

where  $N_{ij}$  is the number of firms in industry  $j$  in country  $i$ . Skewness of the sample of firm sizes in country  $i$  and industry  $j$ , denoted  $\text{skew}_{ij}$ , is calculated as

$$\text{skew}_{ij} = \frac{\frac{1}{N_{ij}} \sum_f (s_{fij} - \text{mean}_{ij})^3}{\left(\frac{1}{N_{ij}} \sum_f (s_{fij} - \text{mean}_{ij})^2\right)^{\frac{3}{2}}}$$

where  $\text{mean}_{ij}$  is defined as above. We also perform a country-level analysis at a higher level of aggregation using

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expropriation by the government, accounting standards, efficiency of the judicial system, the anti-director index, and the creditor-rights index. However the last two are available only for the 49 countries in LaPorta et al. (1998a).

$$\text{mean}_i = \frac{1}{N_i} \sum_{f,j} s_{fij}$$

where  $N_i$  is the number of firms in country  $i$ . Skewness of the sample of firm sizes in country  $i$ , denoted  $\text{skew}_i$ , is then calculated as

$$\text{skew}_i = \frac{\frac{1}{N_i} \sum_{f,j} (s_{fij} - \text{mean}_i)^3}{\frac{1}{N_i} \sum_{f,j} (s_{fij} - \text{mean}_i)^{\frac{3}{2}}}$$

As noted by di Giovanni and Levchenko (2009), the coverage of ORBIS varies widely across countries, with smaller firms under-represented in the majority of countries. To deal with this issue, we estimate the exponent of a Pareto distribution from the FSD data after selecting a minimum cut-off for firm size using visual inspection of the density graphs for each country, as detailed in Gabaix. Following Gabaix and Ibragimov (2009), we then estimate for each country  $i$

$$\log(\text{rank}_{fij} - \frac{1}{2}) = a_i - b_i \cdot \log(\text{size}_{fij})$$

and use the estimated exponent  $b_i$  in our cross-country regression later.<sup>5</sup>

### 3.3.4 Results

#### 3.3.4.1 Aggregate volatility

The following graphs provide partial correlations between four measures of aggregate volatility and the measure of institutional quality.

We also estimate four separate country-level regressions of the following form

$$\text{SD}(\text{growth})_i = \alpha + \beta' X_i + \epsilon_i \tag{3.1}$$

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<sup>5</sup>We estimate  $b_i$  for the set of 44 countries in di Giovanni and Levchenko (2009). Their sample is restricted to countries that have sales figures for at least 1000 firms. Our estimates are provided in the appendix.

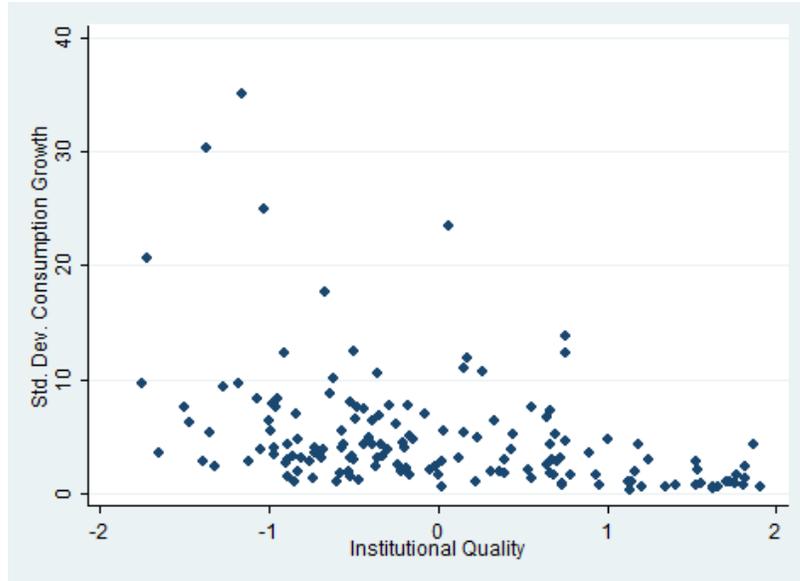


Figure 3.1: Consumption volatility (2000-2008) and Institution Quality. Data source: WorldBank (2008) and Kaufmann et al. (2008)

where  $SD_i$  are the four standard deviations and  $X_i$  is a set of country-level controls. The results (reported in appendix C.2) show that volatility, measured by the standard deviation of GDP and consumption growth rates, is robustly negatively correlated with general institutional quality while controlling for country size, level of general development, trade openness, financial development, and financial openness. Volatility measured by the standard deviation of gross investment and gross fixed investment growth, is negatively correlated with general institutional quality while controlling for country size, level of general development, trade openness, and financial openness. However, institutions are not a statistically significant determinant of volatility when controlling for the financial development of a country. This is not surprising because financial development, measured here by domestic credit to the private sector as a percentage of GDP, affects investment directly, while in turn being influenced by the quality of domestic institutions in possibly non-linear ways.

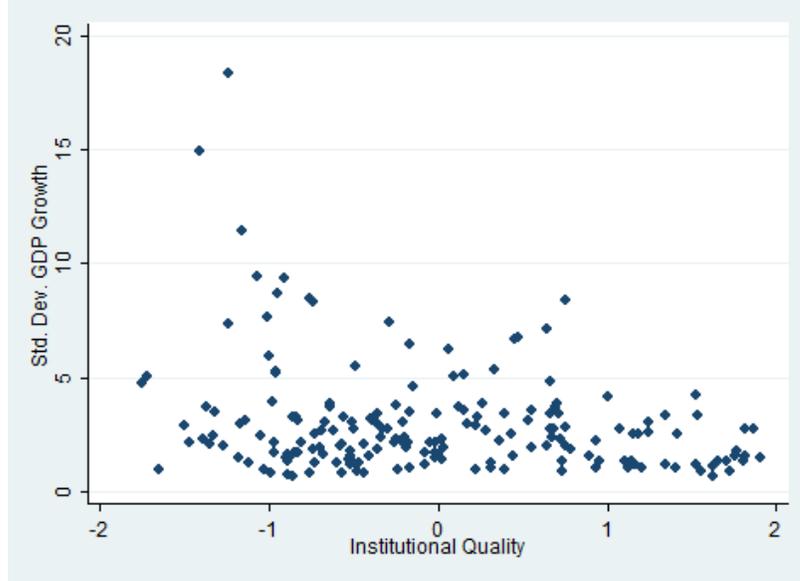


Figure 3.2: GDP volatility (2000-2008) and Institution Quality. Data source: World-Bank (2008) and Kaufmann et al. (2008)

### 3.3.4.2 Country risk premium

We repeat the exercise with a measure of aggregate intermediated financing costs (the country risk premium). The scatter plot shows better institutional quality is partially negatively correlated with lower risk premia.

However, estimation of the country-level regression (results not reported)

$$\text{risk premium}_i = \alpha + \beta' X_i + \epsilon_i \quad (3.2)$$

with a set of country-level controls,  $X_i$ , reveals that financing costs, measured by the country risk premium, though partially negatively correlated with institutional quality, is insignificantly so when controlling for the general development of a country as measured by its per capita GDP.

### 3.3.4.3 Prevalence of market finance

The scatter plot below shows that both of our measures of the prevalence of market finance, the logarithm of the number of listed firms and stock market capital-

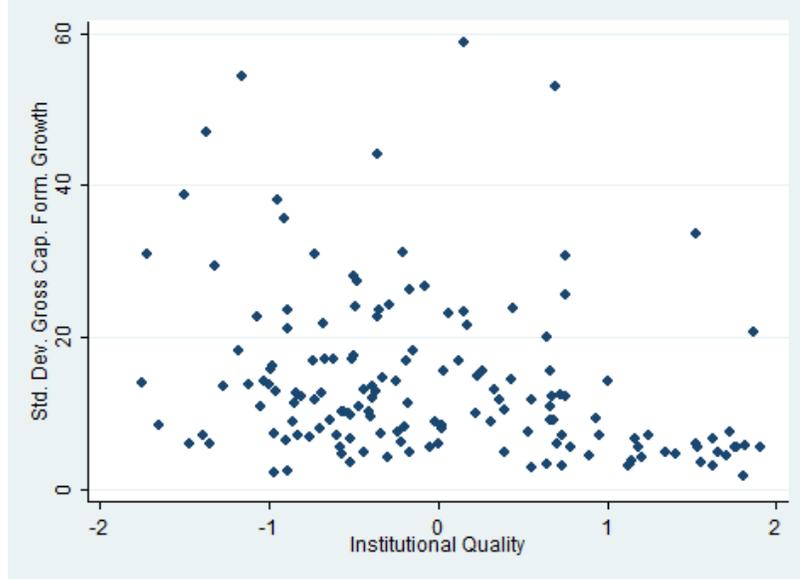


Figure 3.3: Gross capital formation volatility (2000-2008) and Institution Quality. Data source: WorldBank (2008) and Kaufmann et al. (2008)

ization as a percentage of GDP, are partially negatively correlated with the measure of institutional quality.

As before, we estimate two separate country-level regressions, one for each measure of market finance.

$$\text{mkt fin}_i = \alpha + \beta' X_i + \epsilon_i \quad (3.3)$$

where  $X_i$  is a set of country-level controls. We find that both measures of the prevalence of market finance are negatively correlated with general institutional quality while controlling for country size and level of general development (see appendix C.2). However, institutions are not a statistically significant determinant of market finance prevalence when controlling for the financial development of a country using domestic credit to the private sector as percentage of GDP. This, as noted before, is not surprising.

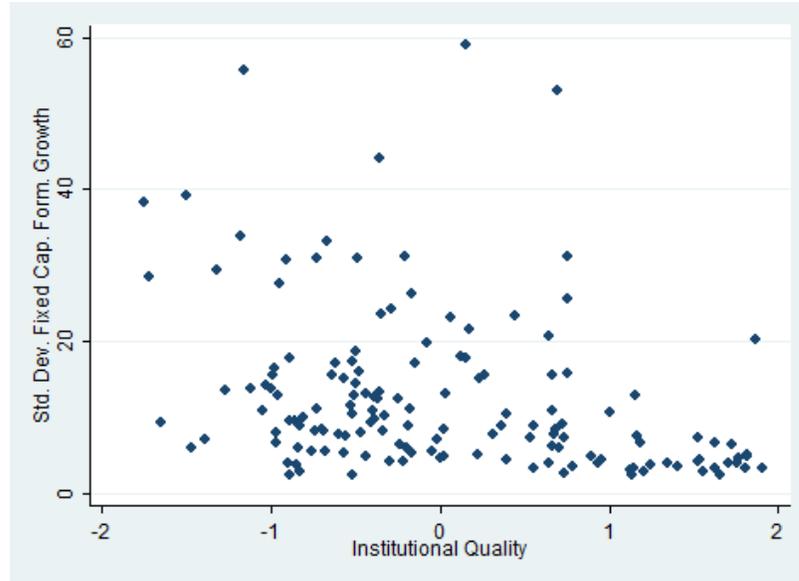


Figure 3.4: Gross fixed capital formation volatility (2000-2008) and Institution Quality. Data source: WorldBank (2008) and Kaufmann et al. (2008)

#### 3.3.4.4 Mean and skewness of firm sizes at the country level

The distribution of the logarithm of the firm size proxies are approximately normal. The following figure presents the non-parametric (kernel density) estimates of the *world* FSD using the country-level mean logarithm of sales in 2006. The first graph in the panel is for the entire sample of countries, while the second one includes only those countries for which ORBIS covers at least 100 firms. The line with the higher peak is the estimated FSD in the sample of countries with below median institutional quality. Visually, the estimated FSD show that countries with above median institutional quality have frequency weights more evenly spread out among firm sizes than countries with below median institutions. Thus, smaller firms appear to have a higher chance of coming into existence and surviving in such countries. On the other hand, the proportion of medium-sized firms is much larger than the proportion of smaller firms in countries with below average institutional quality. This pattern is consistent with the story that firms with low productivity find it harder to raise external finance in such countries due to the higher equilibrium cost of intermediated

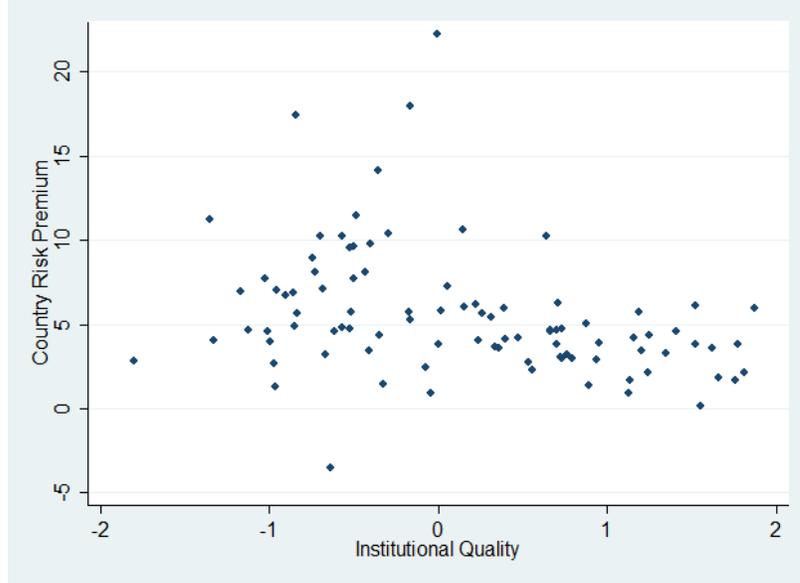


Figure 3.5: Financing Costs (2000-2008) and Institution Quality. Data source: WorldBank (2008) and Kaufmann et al. (2008)

finance. We also find this pattern for the sales data in 2007 and the employment data for 2006-2007. The graphs are shown in appendix C.2.

To investigate this pattern more closely, we estimate country-level regressions with the mean and skewness of firm sizes in each country as the dependent variable, using both measures of firm size. We only include countries that have a minimum number of firm size observations for the following reasons.<sup>6</sup> First, the mean and skewness cannot be meaningfully interpreted if calculated from too few observations. Second, ORBIS coverage varies markedly across countries and is correlated with country size, capital market openness, and most importantly for our purposes, institutional quality. Thus our mean and skewness estimates might be correlated with institutional quality because of ORBIS's sampling process.<sup>7</sup> The estimated regressions are

$$\text{mean}_i = \alpha + \beta' X_i + \epsilon_i \quad (3.4)$$

<sup>6</sup>We experiment with various cut-offs and report results for a cut-off of 100 observations.

<sup>7</sup>The results for skewness are quite different for the entire sample which includes many countries with very few observations.

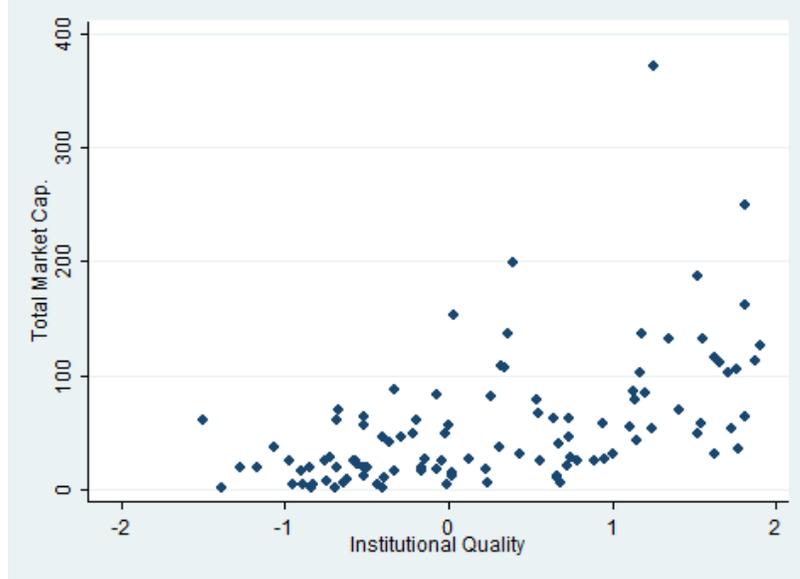


Figure 3.6: Market capitalization (2000-2009) and Institution Quality. Data source: WorldBank (2008) and Kaufmann et al. (2008)

and

$$\text{skew}_i = \alpha + \beta' X_i + \epsilon_i. \quad (3.5)$$

The results (reported in appendix C.2) show that mean firm size is robustly negatively correlated with general institutional quality. This indicates that on average, smaller firms have a higher chance of formation and survival in countries with *better* institutional quality.

The conclusion for the skewness of firm sizes is more tentative because the results are sensitive to the cut-off minimum number of observation that is used to determine the sample. As noted before, there is reason to believe that the process by which ORBIS samples firms might affect our results for low cut-offs. We use a cut-off of 100 observations for our benchmark reported results. Overall, the regressions indicate that countries with stronger institutions have a firm size distribution that is more skewed towards smaller firms, that is, have a higher positive value of skewness on average.

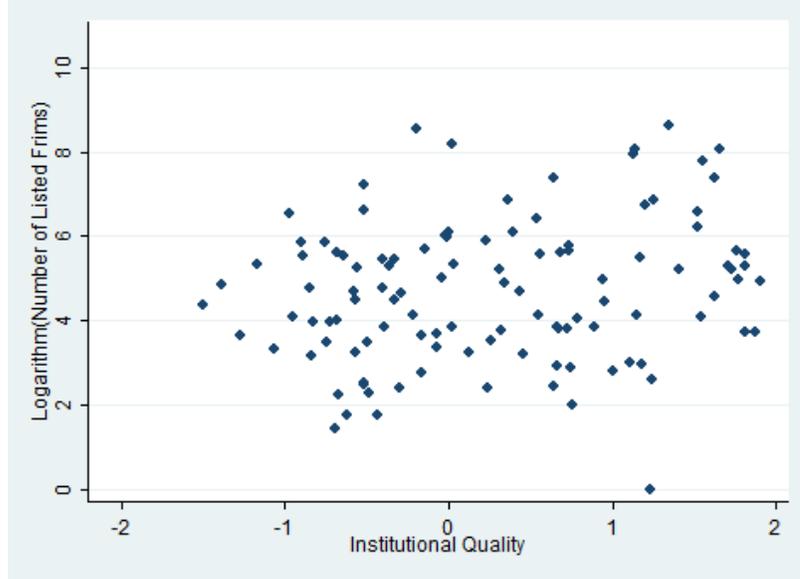


Figure 3.7: Logarithm of number of listed firms (2000-2009) and Institution Quality. Data source: WorldBank (2008) and Kaufmann et al. (2008)

These regressions do not control for the industry composition of a country’s firms. Since different industries, due to technological reasons, have fundamentally different FSD, it is possible that the country-level analysis is just picking up the relative prevalence of certain industries in certain countries. To rule out this possibility, we extend this analysis in the next section to include industry dummies.

### 3.3.4.5 Mean and skewness of firm sizes with industry dummies

We run the same regressions using data at the country-industry level of aggregation. Our dependent variables are now mean and skewness of firm size in country  $i$  and industry  $j$ . Our sample of countries is further eroded since we now estimate these at a higher level of disaggregation and only include country-industry pairs that have a minimum number of firm size observations.

$$\text{mean}_{ij} = \alpha + \beta' X_i + \gamma' \delta_j + \epsilon_{ij} \quad (3.6)$$

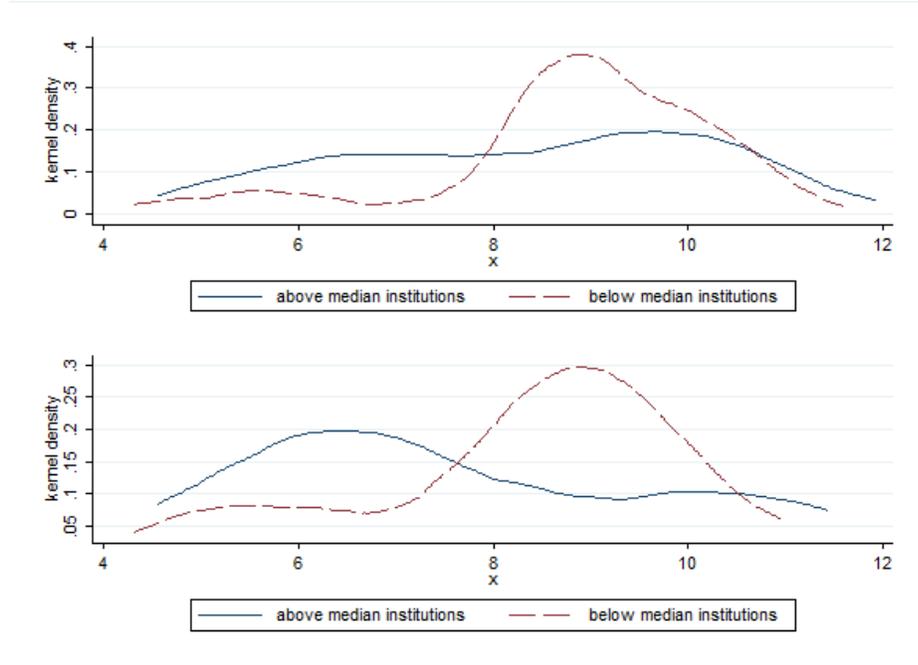


Figure 3.8: Firm size distributions using logarithm of 2006 sales. Data source: ORBIS and Kaufmann et al. (2008)

$$\text{skew}_{ij} = \alpha + \beta' X_i + \gamma' \delta_j + \epsilon_{ij} \quad (3.7)$$

where  $\delta_j$  is a dummy for industry  $j$ .  $j$  runs from 0 to 9 for the ten broad one-digit Standard Industrial Classification (SIC) code industries. The results (reported in appendix C.2) show that mean firm size and skewness are robustly negatively correlated with general institutional quality across countries, within each one-digit SIC industry. This indicates that on average, smaller firms have a higher chance of formation and survival in countries with *better* institutional quality, while controlling for the specific technological characteristics of a particular industry.<sup>8</sup>

Institutional quality is not significantly correlated with the skewness of firm sizes when industry dummies are included. However, because of the reduction in sample size when using country-industry pairs, it is harder to draw a firm conclusion regarding this effect. At the same time, the finding is consistent with those in Champonnois

<sup>8</sup>All one-digit SIC industries show this feature except the government sector (SIC 9).

(2008), who finds that industry factors explain more of the variation in the parameters of FSD around the world than country factors.

### 3.3.4.6 Country level regressions with estimated Pareto exponent

We use the Pareto exponents estimate,  $b_i$ , for the truncated FSD in each country to run a cross country regression of the following form

$$b_i = \alpha + \beta' X_i + \epsilon_i \quad (3.8)$$

for the countries in the sample of di Giovanni and Levchenko (2009). The estimated  $\beta$  shows the value of the Pareto exponent to be significantly positively correlated with institutional quality. This can be interpreted as saying that if we take into account only the upper tail of the FSD in the set of countries that have comparable data, better institutional quality is associated with a higher proportion of relatively large firms.<sup>9</sup> Though this finding should be interpreted with caution, it can be argued that firms have a better chance of finding the financial resources to expand in a country with better institutional quality.<sup>10</sup>

## 3.4 Discussion and conclusion

This paper establishes four broad stylized facts related to institutional quality. We find, using country and industry level regressions, that countries with stronger domestic institutions have smaller average firm sizes and a more positively skewed FSD overall, while having a higher proportion of large firms when taking into account only the upper tail of the FSD. They also exhibit lower macroeconomic volatility, measured by the standard deviation of the growth rates of GDP and consumption,

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<sup>9</sup>The truncation point is different for each country in practice. However, the result holds even when the same truncation point is selected for each country, at the cost of goodness of fit.

<sup>10</sup>In a regression with multiple controls, financial variables like domestic capital market development and financial openness are positive and significant.

use more market finance, measured by the number of listed companies and market capitalization as a percentage of GDP, and have lower domestic risk premia. These results hold more strongly for a cross section of countries than an industry-country cross section, suggesting that the industrial structure of countries plays a large role in determining its FSD. However, since industrial structure may itself be an outcome of country-level factors like institutional quality, a significant role for the latter cannot be ruled out.

Firm vintage has been shown to be an important determinant of the skewness of FSD in a number of studies such as Cabral and Mata (2003), Desai et al. (2003), and Angelini and Generale (2008). For example, in their study of Portuguese firms, Cabral and Mata (2003) find that firm age is a more important determinant of the skewness of the FSD than firm selection: the FSD for firms which survived between 1984 and 1991 was substantially less skewed in 1991 than in 1984. A drawback of our analysis is that we do not estimate FSD for different vintages of firms. However, such an extension is likely to strengthen the main finding of this paper, that FSD is more skewed in countries with weaker domestic institutional quality, because these papers find that the FSD for younger firms is more skewed than those for older firms.

Another shortcoming is that the empirical specifications used in this paper, though guided by some priors, are not derived from an underlying structural model. This paper can be seen as a first step in this direction – we compile some basic stylized facts about micro level FSD and macro level volatility that such a model must try to replicate. An important area of future inquiry may be the theoretical link between firm-level agency problems, FSD, and macro volatility.

## APPENDICES

## APPENDIX A

# Appendices for “Country Portfolios with Imperfect Corporate Governance”

### A.1 Data description

#### A.1.1 Data sources

Table A.1: Data sources

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Source paper	Data	Countries	Coverage
Lane and Milesi-Ferretti (2007)	External wealth	145	1970-2004
Heston et al. (2006)	Capital stock, Investment	188	1950-2004
Kho et al. (2006)	Insider ownership	46	1994, 2004
LaPorta et al. (1998b)	Governance	49	NA
Kaufmann et al. (2008)	Governance	212	1996-2007
WorldBank (2008)	Trade, GDP; Financial development	126; 104	Variable

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### A.1.2 Samples

**Sample 1:** Intersection of set of countries used in LaPorta et al. (1998b), and covered by WorldBank (2008), excluding financial centers Ireland and Switzerland (total  $FA + FL > 150\%$  of GDP). 43 countries are: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Denmark, Ecuador, Egypt, Finland, France, Germany, Greece, India, Indonesia, Israel, Italy, Japan, Jordan, Kenya, Malaysia, Mexico, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Peru, Philippines, Portugal, Singapore, South Africa, Spain, Sri Lanka, Sweden, Thailand, Turkey, United Kingdom United States, Uruguay and Zimbabwe. The original LaPorta et al. (1998b) sample covers 49 countries from Europe, North and South America, Africa, Asia, and Australia. There are no socialist or transition economies in their sample. A country is selected for inclusion by them, if, on the basis of the Worldscope sample of 15,900 firms from 33 countries and the Moodys International sample of 15,100 non-U.S. firms from 92 countries, that country had at least 5 domestic nonfinancial publicly traded firms with no government ownership in 1993.

**Sample 2:** This sample is used to test if worse institutions affect portfolios primarily through increasing insider ownership and decreasing the float portfolio. Intersection of set of countries used in Kho et al. (2006), and covered by WorldBank (2008), excluding financial centers Ireland, Luxembourg and Switzerland (total  $FA + FL > 150\%$  of GDP). 34 countries are: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Denmark, Finland, France, Germany, Greece, India, Indonesia, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Norway, Pakistan, Peru, Poland, Portugal, Singapore, South Africa, Spain, Sweden, Thailand, Turkey, United Kingdom and United States.

### A.1.3 Correlations between governance indices and dependent variables

The following table shows the correlations between my dependent variables, which are foreign assets and liabilities as a fraction of GDP (Lane and Milesi-Ferretti (2007)), and the six components of my institutional quality measure, taken from Kaufmann et al. (2008). All six measures show high correlation with the dependent variables, except for “voice”. Thus the relationship between the institutional quality measure, which is the simple average of the six measures, and the dependent variables is not likely to be driven by a single measure.

Table A.2: Pairwise correlations of dependent variables and individual components of the institutional quality index (for Sample 1)

	$\frac{FA+FL}{GDP}$	$\frac{FA}{GDP}$	$\frac{FL}{GDP}$
General governance	0.7018	0.7267	0.6222
Corruption	0.6809	0.7029	0.6064
Rule of law	0.6088	0.6367	0.5320
Political stability	0.6023	0.6141	0.5461
Regulations	0.6611	0.6633	0.6129
Voice	0.4686	0.5033	0.3927

The following table shows that the institutional quality measure is correlated with the measures constructed by LaPorta et al. (1998b). The measure seeks to capture those aspects of general institutional quality which facilitate contract enforcement between outside investors and insiders. It should be noted here that the anti-director index and the creditor-rights index constructed by LaPorta et al. (1998b), which are more direct measures of investor protection and creditor protection respectively, are weakly correlated with the above measures. This is because the *presence* of

protective laws is related to the legal origin of the country. I place more importance on institutional quality as a good proxy for the *enforcement* of rules.

Table A.3: Pairwise correlations of institutional quality index and select indices from LaPorta et al. (1998b) (for Sample 1)

	rulelaw	repud	riskexp	account	effjud
Institutional quality	0.94	0.90	0.90	0.52	0.69

Table A.4: Pairwise correlations of dependent and independent variables. FA: Foreign FDI and Portfolio Assets, FL: Foreign FDI and Portfolio Liabilities

	$\frac{FA+FL}{GDP}$	$\frac{FA}{GDP}$	$\frac{FL}{GDP}$
Institutional quality	0.6458	0.7217	0.5224
GDP	0.6211	0.6944	0.5022
Per capita GDP	0.5840	0.6491	0.4755
$\frac{\text{Export+Imports}}{GDP}$	0.5862	0.6339	0.4932
$\frac{\text{Dom. credit to pvt. sec.}}{GDP}$	0.6241	0.6662	0.5330

FA: Foreign FDI and Portfolio Assets; FL: Foreign FDI and Portfolio Liabilities; rulelaw: Rule of law; repud: Risk of contract repudiation by government; riskexp: Risk of expropriation by government; account: Accounting standards; effjud: Efficiency of judicial system. Data source: LaPorta et al. (1998b), Lane and Milesi-Ferretti (2007), Kaufmann et al. (2008) and WorldBank (2008). Sample: intersection of set of countries used in LaPorta et al. (1998b), and covered by WorldBank (2008), excluding financial centers Ireland, Luxembourg and Switzerland (total FA + FL > 150% of GDP).

Table A.5: Ownership concentration in low and high institutional quality nations:  
two-sample t-test across two groups of countries with below and above  
median quality of institutions

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
low (0)	19	.5462579	.0342863	.1494505	.4742251	.6182907
high (1)	18	.3990222	.0395198	.1676683	.3156427	.4824017
combined	37	.4746297	.0284791	.1732316	.4168714	.532388
diff		.1472357	.0521535		.0413584	.2531129
$H_0$ : diff = 0						d.f.= 35
$H_a$ : diff < 0				$H_a$ : diff $\neq$ 0		$H_a$ : diff > 0
Pr(T < t)	= 0.9961			Pr( T  >  t ) = 0.0078	Pr(T > t)	= 0.0039

## A.2 Regressions

Table A.6: Foreign assets: OLS regression coefficients

	(1)	(2)	(3)	(4)	(5)
Institutions	<b>.045***</b> (.008)	<b>.047***</b> (.009)	<b>.035**</b> (.016)	<b>.025**</b> (.012)	<b>.032***</b> (.011)
GDP		-.014(.01)	-.023(.015)	-.005(.01)	.007(.012)
GDP p.c.			.004(.005)	.004(.004)	.004(.003)
Trade/GDP				<b>.002***</b> (.0004)	<b>.002***</b> (.0003)
Fin. dev.					-.0009(.0007)
Constant	-.022(.015)	-.02(.014)	-.019(.015)	<b>-.124***</b> (.024)	<b>-.104***</b> (.023)
Observations	43	43	43	43	43
Adj. R-squared	0.4807	0.4792	0.4748	0.7168	0.7264

Point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three or four significant digits. Specifications (1), (2), (3), (4) and (5), all with a constant term, consecutively add the regressors mentioned in the first column. Coefficients marked **\*\*\***, **\*\***, and **\*** are significant at 1%, 5%, and 10% respectively. Dependent variable: total foreign portfolio and FDI assets. Independent variables: Institutional quality index is the *square* of the Kaufmann et al. (2008) index normalized such that the country with the lowest score is 0; GDP in trillions of USD; per capita GDP in thousands of USD; trade as percentage of GDP; domestic credit to private sector as percentage of GDP. Data sources: Lane and Milesi-Ferretti (2007), Kaufmann et al. (2008) and WorldBank (2008). Sample: intersection of set of countries used in LaPorta et al. (1998b), and covered by World-

Bank (2008), excluding financial centers Ireland, Luxembourg and Switzerland (total FA + FL > 150% of GDP).

Table A.7: Foreign liabilities: OLS regression coefficients

	(1)	(2)	(3)	(4)	(5)
Institutions	<b>.031</b> ***(.007)	<b>.034</b> ***(.008)	<b>.049</b> ***(.011)	<b>.04</b> ***(.008)	<b>.045</b> ***(.008)
GDP		<b>-.023</b> **(.01)	-.011(.012)	.005(.008)	.014(.009)
GDP p.c.			-.005(.004)	<b>-.005</b> **(.002)	<b>-.006</b> **(.003)
Trade/GDP				<b>.002</b> ***(.0002)	<b>.002</b> ***(.0001)
Fin. dev.					-.0006(.0003)
Constant	<b>.086</b> ***(.019)	<b>.09</b> ***(.018)	<b>.089</b> ***(.018)	-.006(.021)	.008(.023)
Observations	43	43	43	43	43
Adj. R-squared	0.3528	0.3830	0.3912	0.6987	0.7026

Point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three or four significant digits. Specifications (1), (2), (3), (4) and (5), all with a constant term, consecutively add the regressors mentioned in the first column. Coefficients marked \* \* \*, \*\*, and \* are significant at 1%, 5%, and 10% respectively. Dependent variable: total foreign portfolio and FDI liabilities. Independent variables: Institutional quality index is the *square* of the Kaufmann et al. (2008) index normalized such that the country with the lowest score is 0; GDP in trillions of USD; per capita GDP in thousands of USD; trade as percentage of GDP; domestic credit to private sector as percentage of GDP. Data sources: Lane and Milesi-Ferretti (2007), Kaufmann et al. (2008) and WorldBank (2008). Sample: intersection of set of countries used in LaPorta et al. (1998b), and covered by WorldBank (2008), excluding financial centers Ireland, Luxembourg and Switzerland (total FA + FL > 150% of GDP).

## A.3 Some analytical results

### A.3.1 Planner's problem

The social planner allocates consumption between outsiders of the two countries taking the sum of income (labor and dividend income) in each period as given (denoted by subscript “eq”). Since the planner has a static allocation problem after the realization of the state  $s_t$ , I drop the state notation. Since asset trade takes place between outsiders only, any capital gains do not affect the sum of their incomes.

$$\max_{\{C, C^*\}} U(C, L_{\text{eq}}) + U(C^*, L^*_{\text{eq}})$$

subject to,

$$C(s^t) + e_{\text{eq}}C^* = \psi_0 q_{a_{\text{eq}}} Y_{a_{\text{eq}}} + \psi^*_0 q_{b_{\text{eq}}} Y_{b_{\text{eq}}} + (1 - \alpha)D_{\text{eq}} + (1 - \alpha)e_{\text{eq}}D^*_{\text{eq}}$$

The solution to this problems requires

$$\frac{U_C}{U_{C^*}} = \frac{1}{e}$$

Portfolios which yield this allocation of consumption between outsiders will effectively replicate the constrained Pareto efficient allocation in this economy.

### A.3.2 Proof of Proposition 1

Consider the budget constraints of the outsiders in the two countries.

$$\begin{aligned}
C(s^t) + P(s^t)(\lambda_{NN}(s^t) - \lambda_{NN}(s^{t-1})) + e(s^t)P^*(s^t)(\lambda_{NS}(s^t) - \lambda_{NS}(s^{t-1})) \\
&= q_a(s^t)W(s^t)L(s^t) + \lambda_{NN}(s^t)D(s^t) + \lambda_{NS}(s^t)e(s^t)D^*(s^t) \\
C^*(s^t) + \frac{P(s^t)(\lambda_{SN}(s^t) - \lambda_{SN}(s^{t-1}))}{e(s^t)} + P^*(s^t)(\lambda_{SS}(s^t) - \lambda_{SS}(s^{t-1})) \\
&= q_a(s^t)W(s^t)L(s^t) + \frac{\lambda_{SN}(s^t)D(s^t)}{e(s^t)} + \lambda_{SS}(s^t)D^*(s^t)
\end{aligned}$$

With time invariant optimal portfolio shares the budget constraints reduce to

$$\begin{aligned}
C(s^t) &= q_a(s^t)W(s^t)L(s^t) + \lambda_{NN}D(s^t) + \lambda_{NS}e(s^t)D^*(s^t) \\
C^*(s^t) &= q_b(s^t)W^*(s^t)L^*(s^t) + \frac{\lambda_{SN}D(s^t)}{e(s^t)} + \lambda_{SS}D^*(s^t)
\end{aligned}$$

Using the first order conditions for employment and stealing from the insiders' problem,

$$\begin{aligned}
W(s^t)L(s^t) &= \frac{1-\theta}{\alpha} \left( \alpha + \frac{(1-\alpha)^2}{2\eta} \right) Y_a(s^t) \\
W^*(s^t)L^*(s^t) &= \frac{1-\theta}{\alpha} \left( \alpha + \frac{(1-\alpha)^2}{2\eta} \right) Y_b(s^t) \\
f(s^t) &= \frac{1-\alpha}{\eta} \\
f^*(s^t) &= \frac{1-\alpha}{\eta}
\end{aligned}$$

the dividend flows

$$D(s^t) = q_a(s^t)[\{1 - f(s^t)\}\{Y_a(s^t)\} - W(s^t)L(s^t)] - \{K(s^t) - (1 - \delta)K(s^{t-1})\}$$

$$D^*(s^t) = q_b(s^t)[\{1 - f^*(s^t)\}\{Y_b(s^t)\} - W^*(s^t)L^*(s^t)] - \{K^*(s^t) - (1 - \delta)K^*(s^{t-1})\}$$

can be written as

$$D(s^t) = q_a(s^t)Y_a(s^t)[\psi_1 - \psi_0] - I(s^t)$$

$$D^*(s^t) = q_b(s^t)Y_b(s^t)[\psi_1 - \psi_0] - I^*(s^t)$$

where

$$\psi_0 = (1 - \theta)\left\{1 + \frac{(1 - \alpha)^2}{2\alpha\eta}\right\}$$

$$\psi_1 = \frac{\eta + \alpha - 1}{\eta}$$

Thus the budget constraints reduce to

$$C(s^t) = \psi_0 y(s^t) + \lambda_{NN}[(\psi_1 - \psi_0)y(s^t) - I(s^t)] + \lambda_{NS}e(s^t)[(\psi_1 - \psi_0)y^*(s^t) - I^*(s^t)]$$

$$C^*(s^t) = \psi_0 y^*(s^t) + \frac{\lambda_{SN}}{e(s^t)}[(\psi_1 - \psi_0)y(s^t) - I(s^t)] + \lambda_{SS}[(\psi_1 - \psi_0)y^*(s^t) - I^*(s^t)]$$

where, for notational simplicity, I have

$$I(s^t) = K(s^t) - (1 - \delta)K(s^{t-1})$$

$$I^*(s^t) = K^*(s^t) - (1 - \delta)K^*(s^{t-1})$$

$$y(s^t) = q_a(s^t)Y_a(s^t)$$

$$y^*(s^t) = q_b(s^t)Y_b(s^t)$$

With logarithmic utility, the planner's constrained Pareto efficient consumption allocations are

$$C(s^t) = e(s^t)C^*(s^t)$$

If there exists a portfolio share  $\lambda$  such that this condition holds for all states, then  $\lambda$  must satisfy

$$C(s^t) - e(s^t)C^*(s^t) = [\psi_0 + (\psi_1 - \psi_0)(2\lambda + \alpha - 1)]\{y(s^t) - e(s^t)y^*(s^t)\} - (2\lambda + \alpha - 1)\{I(s^t) - e(s^t)I^*(s^t)\} =$$

where I have expressed all portfolio shares in terms of  $\lambda$  by using symmetry and market clearing in asset markets, which imply

$$\lambda_{NN} = \lambda$$

$$\lambda_{SN} = 1 - \alpha - \lambda$$

$$\lambda_{NS} = 1 - \alpha - \lambda$$

$$\lambda_{SS} = \lambda$$

Now,

$$\begin{aligned}
y(s^t) &= q_a(s^t)Y_a(s^t) \\
&= q_a(s^t)\{a(s^t) + a^*(s^t)\} \\
&= \omega Y(s^t) + (1 - \omega)e(s^t)Y^*(s^t)
\end{aligned}$$

and

$$\begin{aligned}
y^*(s^t) &= q_b(s^t)Y_b(s^t) \\
&= q_b(s^t)\{b(s^t) + b^*(s^t)\} \\
&= (1 - \omega)\frac{Y(s^t)}{e(s^t)} + \omega Y^*(s^t)
\end{aligned}$$

Henceforth for all variables  $x$ ,  $\Delta x(s^t)$  denotes the value of  $x(s^t) - e(s^t)x^*(s^t)$ . Therefore

$$\begin{aligned}
\Delta y(s^t) &= y(s^t) - e(s^t)y^*(s^t) \\
&= (2\omega - 1)\{Y(s^t) - e(s^t)Y^*(s^t)\} \\
&= (2\omega - 1)\Delta Y(s^t)
\end{aligned}$$

Using the final-goods market-clearing conditions and the expression for the insiders' consumption demand

$$\begin{aligned}
Y(s^t) &= C(s^t) + K(s^t) - (1 - \delta)K(s^{t-1}) + M(s^t) + \Phi(s^t) \\
Y^*(s^t) &= C_{m^*}(s^t) + K^*(s^t) - (1 - \delta)K^*(s^{t-1}) + M^*(s^t) + \Phi^*(s^t) \\
M(s^t) &= \alpha D(s^t) + q_a(s^t)f(s^t)Y_a(s^t) - \Phi(s^t) \\
M^*(s^t) &= \alpha D^*(s^t) + q_b(s^t)f^*(s^t)Y_b(s^t) - \Phi^*(s^t)
\end{aligned}$$

together with the expressions for the optimal stealing fraction and dividends, we have

$$\begin{aligned}
\Delta y(s^t) &= (2\omega - 1)\Delta Y(s^t) \\
&= (2\omega - 1)[\Delta C(s^t) + \Delta I(s^t) + \{\alpha\theta + \frac{(1 + \theta)(1 - \alpha)^2}{2\eta}\}\Delta y(s^t) - \alpha\Delta I(s^t)]
\end{aligned}$$

This gives after some algebra

$$\Delta y(s^t) = \frac{(2\omega - 1)}{\psi_2} \{\Delta C(s^t) + (1 - \alpha)\Delta I(s^t)\}$$

where

$$\psi_2 = 1 - (2\omega - 1)\{\alpha\theta + \frac{(1 + \theta)(1 - \alpha)^2}{2\eta}\}$$

Now, plugging in the value of  $\Delta y(s^t)$  in the expression for  $\Delta C(s^t)$ , we get, for some constant  $\mu$

$$\mu\Delta C(s^t) = [\psi_2^{-1}(1 - \alpha)(2\omega - 1)\{\psi_0 + (\psi_1 - \psi_0)(2\lambda + \alpha - 1)\} - (2\lambda + \alpha - 1)]\Delta I(s^t)$$

This expression gives us the value of the portfolio share,  $\lambda$ , that will ensure that the complete markets condition,  $\Delta C(s^t) = 0$ , holds for all states. The value of  $\lambda$  is calculated by simply assuming this the condition holds, and then solving for  $\lambda$ .

This completes the proof of Proposition 1 in section (1.4.2).

### A.3.3 Proof of Proposition 2

Since portfolio shares are constant, consumption of Northern and Southern outsiders can be written as,

$$C(s^t) = q_a(s^t)W(s^t)L(s^t) + \lambda_{NN}D(s^t) + \lambda_{NS}e(s^t)D^*(s^t)$$

$$C^*(s^t) = q_b(s^t)W^*(s^t)L^*(s^t) + \frac{\lambda_{SN}D(s^t)}{e(s^t)} + \lambda_{SS}D^*(s^t)$$

Denote  $q_a(s^t)W(s^t)L(s^t)$  by  $\mathbb{L}$  and  $q_b(s^t)W^*(s^t)L^*(s^t)$  by  $\mathbb{L}^*$ .  $\lambda$  ensures that

$$C(s^t) = e(s^t)C^*(s^t)$$

Plugging in the values for consumption and log-linearizing the above relationship around the symmetric steady-state we get,

$$\bar{\mathbb{L}}\hat{\mathbb{L}} + \bar{D}\hat{D}\lambda + \bar{e}\bar{D}^*\hat{D}^*(1-\alpha-\lambda) + \bar{e}\bar{D}^*\hat{e}(1-\alpha-\lambda) = \bar{e}\bar{\mathbb{L}}^*\hat{\mathbb{L}}^* + \bar{e}\bar{\mathbb{L}}^*\hat{e} + \bar{D}\hat{D}(1-\alpha-\lambda) + \bar{e}\bar{D}^*\hat{D}^*\lambda + \bar{e}\bar{D}^*\hat{e}\lambda$$

Gathering terms and noting that  $\bar{D}^* = \bar{D}$ ,  $\bar{L}^* = \bar{L}$ ,  $\bar{e} = 1$  in a symmetric equilibrium we get

$$(2\lambda + \alpha - 1)\bar{D}(\hat{D} - \hat{e} - \hat{D}^*) = \bar{\mathbb{L}}(\hat{\mathbb{L}} - \hat{e} - \hat{\mathbb{L}}^*)$$

Denoting  $(\hat{D} - \hat{e} - \hat{D}^*)$  as  $\Delta\hat{D}$  and  $(\hat{\mathbb{L}} - \hat{e} - \hat{\mathbb{L}}^*)$  as  $\Delta\hat{\mathbb{L}}$  we get

$$(2\lambda + \alpha - 1)\bar{D}\Delta\hat{D} = \bar{L}\Delta\hat{L}$$

which gives,

$$(2\lambda + \alpha - 1) = -\frac{\bar{L}}{\bar{D}} \frac{\text{cov}(\Delta\hat{L}, \Delta\hat{D})}{\text{var}(\Delta\hat{D})}$$

Solving for  $\lambda$  gives the result.

#### A.3.4 The steady-state with symmetric countries (and Cobb-Douglas)

If the countries are ex-ante symmetric, then  $\{q_a^{ss}, q_a^{*ss}, q_b^{ss}, q_b^{*ss}\}$  simply reduce to

$$q_a^{ss} = \omega^\omega (1 - \omega)^{1-\omega} \quad (\text{A.1})$$

$$q_a^{*ss} = \omega^\omega (1 - \omega)^{1-\omega} \quad (\text{A.2})$$

$$q_b^{ss} = \omega^\omega (1 - \omega)^{1-\omega} \quad (\text{A.3})$$

$$q_b^{*ss} = \omega^\omega (1 - \omega)^{1-\omega} \quad (\text{A.4})$$

and  $L^{ss} = L^{*ss}$ ,  $\psi_0 = \psi_0^*$ ,  $\psi_1 = \psi_1^*$ . Thus the non-stochastic steady-state values of all other variables can be expressed in terms of just  $L^{ss}$  when the countries are symmetric. The quantity variables are

$$K^{ss} = \left[ \frac{\theta}{1-\theta} \frac{\psi_0 q_a^{ss}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{ss} \quad (\text{A.5})$$

$$K^{*ss} = \left[ \frac{\theta}{1-\theta} \frac{\psi_0^* q_b^{*ss}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{*ss} \quad (\text{A.6})$$

$$Y_a^{ss} = \left[ \frac{\theta}{1-\theta} \frac{\psi_0 \omega^\omega (1-\omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{ss} \quad (\text{A.7})$$

$$Y_b^{ss} = \left[ \frac{\theta}{1-\theta} \frac{\psi_0 \omega^\omega (1-\omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{ss} \quad (\text{A.8})$$

$$a^{ss} = \omega Y_a^{ss} = \omega \left[ \frac{\theta}{1-\theta} \frac{\psi_0 \omega^\omega (1-\omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{ss} \quad (\text{A.9})$$

$$a^{*ss} = (1-\omega) Y_a^{ss} = (1-\omega) \left[ \frac{\theta}{1-\theta} \frac{\psi_0 \omega^\omega (1-\omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{ss} \quad (\text{A.10})$$

$$b^{ss} = (1-\omega) Y_a^{ss} = (1-\omega) \left[ \frac{\theta}{1-\theta} \frac{\psi_0 \omega^\omega (1-\omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{ss} \quad (\text{A.11})$$

$$b^{*ss} = \omega Y_a^{ss} = \omega \left[ \frac{\theta}{1-\theta} \frac{\psi_0 \omega^\omega (1-\omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{ss} \quad (\text{A.12})$$

$$Y^{ss} = q_a^{ss} Y_a^{ss} = \omega^\omega (1 - \omega)^{1-\omega} \left[ \frac{\theta}{1 - \theta} \frac{\psi_0 \omega^\omega (1 - \omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{ss} \quad (\text{A.13})$$

$$Y^{*ss} = q_b^{*ss} Y_b^{*ss} = \omega^\omega (1 - \omega)^{1-\omega} \left[ \frac{\theta}{1 - \theta} \frac{\psi_0 \omega^\omega (1 - \omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{*ss} \quad (\text{A.14})$$

$$D^{ss} = \left[ \frac{(1 - \theta)}{\theta} \frac{(\psi_1 - \psi_0)}{\psi_0} \left( \frac{1}{\beta} + \delta - 1 \right) - \delta \right] K^{ss} \quad (\text{A.15})$$

$$D^{*ss} = \left[ \frac{(1 - \theta)}{\theta} \frac{(\psi_1 - \psi_0)}{\psi_0} \left( \frac{1}{\beta} + \delta - 1 \right) - \delta \right] K^{*ss} \quad (\text{A.16})$$

$$C^{ss} = (1 - \alpha) D^{ss} + q_a^{ss} W^{ss} L^{ss} \quad (\text{A.17})$$

$$C^{*ss} = (1 - \alpha) D^{*ss} + q_b^{*ss} W^{*ss} L^{*ss} \quad (\text{A.18})$$

$$M^{ss} = \alpha \left( \frac{1}{\beta} - 1 \right) K^{ss} \quad (\text{A.19})$$

$$M^{*ss} = \alpha^* \left( \frac{1}{\beta} - 1 \right) K^{*ss} \quad (\text{A.20})$$

$$I^{ss} = \delta K^{ss} = \delta \left[ \frac{\theta}{1 - \theta} \frac{\psi_0 q_a^{ss}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{ss} \quad (\text{A.21})$$

$$I^{*ss} = \delta K^{*ss} = \delta \left[ \frac{\theta}{1 - \theta} \frac{\psi_0^* q_b^{*ss}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{*ss} \quad (\text{A.22})$$

The parameters  $\eta$  and  $\eta^*$  are selected such that steady state dividends are positive.

In particular

$$\eta > \frac{(1 - \alpha) \{ \theta (1 - \alpha) (1 - \frac{1}{\beta}) - (2 - \alpha) (\frac{1}{\beta} + \delta - 1) \}}{(1 - 2\alpha) (\frac{1}{\beta} + \delta - 1) + 2\alpha \theta (\frac{1}{\beta} - 1)}$$

$$f^{ss} = \frac{1 - \alpha}{\eta} \quad (\text{A.23})$$

$$f^{*ss} = \frac{1 - \alpha^*}{\eta^*} \quad (\text{A.24})$$

and the other prices are

$$P^{ss} = \frac{\beta}{1-\beta} D^{ss} \quad (\text{A.25})$$

$$P^{*ss} = \frac{\beta}{1-\beta} D^{*ss} \quad (\text{A.26})$$

$$R^{ss} = \frac{1}{\beta} - 1 \quad (\text{A.27})$$

$$R^{*ss} = \frac{1}{\beta} - 1 \quad (\text{A.28})$$

$$W^{ss} = \psi_0 \frac{K^{ss\theta}}{L^{ss}} \quad (\text{A.29})$$

$$W^{*ss} = \psi_0^* \frac{K^{*ss\theta}}{L^{*ss}} \quad (\text{A.30})$$

$$e^{ss} = 1 \quad (\text{A.31})$$

As in other models with portfolio selection like Devereux and Sutherland (2007) and Heathcote and Perri (2009), the value of portfolios in the non-stochastic steady-state is indeterminate. With ex-ante symmetric countries, any symmetric value of  $\{\lambda_{NN}, \lambda_{SS}\}$  is an equilibrium, so that

$$\lambda_{NN} = \lambda_{SS} \in [0, 1] \quad (\text{A.32})$$

$$\lambda_{SN} = 1 - \alpha - \lambda_{NN} \quad (\text{A.33})$$

$$\lambda_{NS} = 1 - \alpha^* - \lambda_{SS} \quad (\text{A.34})$$

As a reminder

$$\psi_0 = (1 - \theta) \left\{ 1 + \frac{(1 - \alpha)^2}{2\alpha\eta} \right\}$$

$$\psi_1 = \frac{\eta + \alpha - 1}{\eta}$$

### A.3.5 The steady-state with asymmetric countries

The steady-state value of  $\{K^{ss}, K^{*ss}\}$  can be expressed in terms of  $\{q_a^{ss}, q_a^{*ss}, q_b^{ss}, q_b^{*ss}\}$ , and  $\{L^{ss}, L^{*ss}\}$ , the latter pair being calibrated to the data.

$$K^{ss} = \left[ \frac{\theta}{1 - \theta} \frac{\psi_0 q_a^{ss}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{ss} \quad (\text{A.35})$$

$$K^{*ss} = \left[ \frac{\theta}{1 - \theta} \frac{\psi_0^* q_b^{*ss}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{*ss} \quad (\text{A.36})$$

Substituting in the production function for intermediate goods we get

$$Y_a^{ss} = K^{ss\theta} L^{ss1-\theta} = \left[ \frac{\theta}{1 - \theta} \frac{\psi_0 q_a^{ss}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{ss} \quad (\text{A.37})$$

$$Y_b^{ss} = K^{*ss\theta} L^{*ss1-\theta} = \left[ \frac{\theta}{1 - \theta} \frac{\psi_0^* q_b^{*ss}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{\theta}{1-\theta}} L^{*ss} \quad (\text{A.38})$$

$$(\text{A.39})$$

and from the definition of dividends, the budget constraints of the four agents, and the final goods resource constraint we have

$$D^{ss} = \left[ \frac{(1-\theta)(\psi_1 - \psi_0)}{\theta \psi_0} \left( \frac{1}{\beta} + \delta - 1 \right) - \delta \right] K^{ss} \quad (\text{A.40})$$

$$D^{*ss} = \left[ \frac{(1-\theta)(\psi_1^* - \psi_0^*)}{\theta \psi_0^*} \left( \frac{1}{\beta} + \delta - 1 \right) - \delta \right] K^{*ss} \quad (\text{A.41})$$

$$C^{ss} = Y^{ss} - M^{ss} - I^{ss} - \Phi^{ss} \quad (\text{A.42})$$

$$C^{*ss} = Y^{*ss} - M^{*ss} - I^{*ss} - \Phi^{*ss} \quad (\text{A.43})$$

$$M^{ss} = \alpha \left( \frac{1}{\beta} - 1 \right) K^{ss} \quad (\text{A.44})$$

$$M^{*ss} = \alpha^* \left( \frac{1}{\beta} - 1 \right) K^{*ss} \quad (\text{A.45})$$

$$(\text{A.46})$$

and the other prices are

$$P^{ss} = \frac{\beta}{1-\beta} D^{ss} \quad (\text{A.47})$$

$$P^{*ss} = \frac{\beta}{1-\beta} D^{*ss} \quad (\text{A.48})$$

$$R^{ss} = \frac{1}{\beta} - 1 \quad (\text{A.49})$$

$$R^{*ss} = \frac{1}{\beta} - 1 \quad (\text{A.50})$$

$$W^{ss} = \psi_0 \frac{K^{ss \theta}}{L^{ss}} \quad (\text{A.51})$$

$$W^{*ss} = \psi_0^* \frac{K^{*ss \theta}}{L^{*ss}} \quad (\text{A.52})$$

$$(\text{A.53})$$

The trade balance is zero in the steady-state. Using this fact, and the first order conditions for combining intermediate goods, we get

$$a^{ss} = \frac{\omega^\rho}{\omega^\rho + (1-\omega)^\rho} Y_a^{ss} \quad (\text{A.54})$$

$$a^{*ss} = \frac{(1-\omega)^\rho}{\omega^\rho + (1-\omega)^\rho} Y_a^{ss} \quad (\text{A.55})$$

$$b^{ss} = \frac{(1-\omega)^\rho}{\omega^\rho + (1-\omega)^\rho} Y_b^{ss} \quad (\text{A.56})$$

$$b^{*ss} = \frac{\omega^\rho}{\omega^\rho + (1-\omega)^\rho} Y_b^{ss} \quad (\text{A.57})$$

With  $\rho = 1$  (Cobb-Douglas) we have

$$q_a^{ss} = \omega^\omega (1-\omega)^{1-\omega} \left( \frac{K^*}{K} \right)^{\theta(1-\omega)} \quad (\text{A.58})$$

$$q_a^{*ss} = \omega^\omega (1-\omega)^{1-\omega} \left( \frac{K^*}{K} \right)^{\theta\omega} \quad (\text{A.59})$$

$$q_b^{ss} = \omega^\omega (1-\omega)^{1-\omega} \left( \frac{K}{K^*} \right)^{\theta\omega} \quad (\text{A.60})$$

$$q_b^{*ss} = \omega^\omega (1-\omega)^{1-\omega} \left( \frac{K}{K^*} \right)^{\theta(1-\omega)} \quad (\text{A.61})$$

$$e^{ss} = \left( \frac{K^*}{K} \right)^{\theta(1-2\omega)} \quad (\text{A.62})$$

$$t^{ss} = \left( \frac{K^*}{K} \right)^\theta \quad (\text{A.63})$$

where  $t$  is the terms of trade of the North, all in terms of  $K$  and  $K^*$ . Using the expression connecting  $K$  and  $K^*$  to  $q_a$  and  $q_b^*$ , and the first order conditions for intermediate goods usage we get the expression for the steady-state capital stock as

$$K^{ss} = \zeta \frac{\zeta_1}{\zeta_1^2 - \zeta_2^2} \zeta^* \frac{\zeta_2}{\zeta_1^2 - \zeta_2^2} \quad (\text{A.64})$$

$$K^{*ss} = \zeta \frac{\zeta_2}{\zeta_1^2 - \zeta_2^2} \zeta^* \frac{\zeta_1}{\zeta_1^2 - \zeta_2^2} \quad (\text{A.65})$$

where

$$\zeta = \left[ \frac{\theta}{1-\theta} \frac{\psi_0 \omega^\omega (1-\omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{ss} \quad (\text{A.66})$$

$$\zeta^* = \left[ \frac{\theta}{1-\theta} \frac{\psi_0^* \omega^\omega (1-\omega)^{1-\omega}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{*ss} \quad (\text{A.67})$$

$$\zeta_1 = \frac{1-\theta\omega}{1-\theta} \quad (\text{A.68})$$

$$\zeta_2 = \frac{\theta(1-\omega)}{1-\theta} \quad (\text{A.69})$$

Note that we can get symmetric countries as a special case of the above, when  $\zeta = \zeta^*$ .

For the general aggregating function, we have, following the same procedure

$$q_a^{ss} = \left[ \omega^\rho + (1-\omega)^\rho \left( \frac{K^*}{K} \right)^{\frac{\theta(\rho-1)}{\rho}} \right]^{\frac{1}{\rho-1}} \quad (\text{A.70})$$

$$q_a^{*ss} = \left[ (1-\omega)^\rho + \omega^\rho \left( \frac{K^*}{K} \right)^{\frac{\theta(\rho-1)}{\rho}} \right]^{\frac{1}{\rho-1}} \quad (\text{A.71})$$

$$q_b^{ss} = \left[ \omega^\rho \left( \frac{K}{K^*} \right)^{\frac{\theta(\rho-1)}{\rho}} + (1-\omega)^\rho \right]^{\frac{1}{\rho-1}} \quad (\text{A.72})$$

$$q_b^{*ss} = \left[ (1-\omega)^\rho \left( \frac{K}{K^*} \right)^{\frac{\theta(\rho-1)}{\rho}} + \omega^\rho \right]^{\frac{1}{\rho-1}} \quad (\text{A.73})$$

$$e^{ss} = \left[ \frac{\omega^\rho K^{\frac{\theta(\rho-1)}{\rho}} + (1-\omega)^\rho K^{*\frac{\theta(\rho-1)}{\rho}}}{(1-\omega)^\rho K^{\frac{\theta(\rho-1)}{\rho}} + \omega^\rho K^{*\frac{\theta(\rho-1)}{\rho}}} \right]^{\frac{1}{\rho-1}} \quad (\text{A.74})$$

$$t^{ss} = \left( \frac{\omega}{1-\omega} \right)^{1-\rho} \left( \frac{K^*}{K} \right)^\theta \quad (\text{A.75})$$

and capital stocks are solved from the simultaneous equations

$$K^{ss} = \left[ \frac{\theta}{1-\theta} \frac{\psi_0 \left[ \omega^\rho + (1-\omega)^\rho \left( \frac{K^*}{K} \right)^{\frac{\theta(\rho-1)}{\rho}} \right]^{\frac{1}{\rho-1}}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{ss} \quad (\text{A.76})$$

$$K^{*ss} = \left[ \frac{\theta}{1-\theta} \frac{\psi_0^* \left[ (1-\omega)^\rho \left( \frac{K}{K^*} \right)^{\frac{\theta(\rho-1)}{\rho}} + \omega^\rho \right]^{\frac{1}{\rho-1}}}{\frac{1}{\beta} + \delta - 1} \right]^{\frac{1}{1-\theta}} L^{*ss} \quad (\text{A.77})$$

## A.4 Numerical algorithms

This section contains descriptions of the numerical algorithms used in the paper.

### A.4.1 Algorithm for computing approximate equilibrium for outsiders

1. The first step is to find a point around which to approximate the decision rules. This point is the unique stationary solution to the set of equilibrium conditions of the model, for the case when there is no uncertainty, that is, the scale parameter of the variance of the driving shocks is equal to zero. This is called the non-stochastic steady-state. To ensure stationarity of all variables, and a zero-current account, I follow Schmitt-Grohe and Uribe (2003) in positing a convex portfolio adjustment cost, which pins down a unique non-stochastic steady-state for portfolio variables, and hence for financial wealth. The approximation point for portfolio shares,  $(\lambda_{NN}, \lambda_{NS}), (\lambda_{SN}, \lambda_{SS})$  is arbitrary at this juncture, because in the non-stochastic steady-state, *any* portfolio share which keeps the wealth distribution unchanged with respect to the initial endowment of shares, is an equilibrium. We assume a small convex adjustment cost of changing portfolios from  $(\lambda_{NN}, \lambda_{NS}), (\lambda_{SN}, \lambda_{SS})$ . This is done to keep the foreign wealth position of each country stationary. As noted by Schmitt-Grohe and Uribe (2003), this modification does not significantly affect the dynamics of other macroeconomic variables at the level of approximation that these models are analyzed. This technique is also used by Heathcote and Perri (2009), and like them I find that the cost of adjustment  $\tau$ , can be set to an arbitrarily small positive number. Of course, the higher  $\tau$  is set, the less portfolio shares will diverge from the chosen value of  $(\lambda_{NN}, \lambda_{NS}), (\lambda_{SN}, \lambda_{SS})$ . In this model, I set  $\tau$  to be 0.00001% of the un-weighted average steady-state stock price. Thus the budget constraint of the outsider in the North is as follows.

$$\begin{aligned}
& C(s^t) + P(s^t)(\lambda_{NN}(s^t) - \lambda_{NN}) + e(s^t)P^*(s^t)(\lambda_{NS}(s^t) - \lambda_{NS}) + \frac{\tau}{2}(\lambda_{NN}(s^t) - \lambda_{NN})^2 \\
& + \frac{\tau}{2}(\lambda_{NS}(s^t) - \lambda_{NS})^2 = q_a(s^t)W(s^t)L(s^t) + \lambda_{NN}(s^{t-1})D(s^t) + \lambda_{NS}(s^{t-1})e(s^t)D^*(s^t)
\end{aligned}
\tag{A.78}$$

The steady-state values of all variables are provided in the previous section.

**2.** Around the chosen stationary steady-state, I find second-order Taylor series approximation of the optimal dynamics of the control and state variables using the algorithm developed by Schmitt-Grohé and Uribe (2004).

#### A.4.2 Second-order optimal dynamics

This section provides a brief review of the approximation technique described in Schmitt-Grohé and Uribe (2004), henceforth referred to as SGU, which is used to solve the model.<sup>1</sup> The  $n$  equations characterizing the stochastic equilibrium of this economy can be written in the form

$$E_t f(y_{t+1}, y_t, x_{t+1}, x_t) = 0, \quad f : \mathfrak{R}^{n_y \times n_y \times n_x \times n_x} \rightarrow \mathfrak{R}^n$$

$y$  is a  $n_y \times 1$  vector of control variables and  $x = (x_1, x_2)'$  is a  $n_x \times 1$  vector of state variables, where  $x_1$  and  $x_2$  are respectively  $(n_x - n_\epsilon) \times 1$  and  $n_\epsilon \times 1$  vectors of endogenous and exogenous state variables. The non-stochastic steady-state values of the arguments of  $f(\cdot)$  are denoted by the set  $\{y^{ss}, x^{ss}\}$ , and these values can be solved from

$$f(y^{ss}, y^{ss}, x^{ss}, x^{ss}) = 0$$

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<sup>1</sup>In general, though the certainty-equivalent non-stochastic steady-state, and first-order approximate solution of the model are the same, they do not coincide with the true stochastic solution. This is because second or higher order terms of the true solution are significant in the presence of uncertainty. See Kim and Kim (2003) and Schmitt-Grohé and Uribe (2004) for further discussions of this point.

**Lemma 5.** *For the dynamic system described in the previous sections, there exists a unique, interior stationary solution for all non-portfolio variables, denoted by  $\{y^{ss}, x^{ss}\}_{(-\lambda)}$ .*

**Proof:** See previous section for steady state values. (A.3.4)

Following the notation of SGU, the solution to the model can be written in the form of two functions,  $g(x, \sigma)$  which is the optimal policy function, and  $h(x, \sigma)$  which describes the transition of both the endogenous and exogenous states. Thus

$$\begin{aligned} y &= g(x, \sigma) \\ x' &= h(x, \sigma) + \eta\sigma\epsilon' \end{aligned}$$

where  $\eta$  is a  $n_x \times n_\epsilon$  matrix, partly zeros, describing the variance-covariance structure of the errors in the exogenous driving variables, which in this case are technology in the Northern and Southern intermediate goods sector. The two functions  $g(x, \sigma)$  and  $h(x, \sigma)$  are approximated up to the second order by writing them as functions of the first and second derivative of the function  $f$  in the neighborhood of the approximation point  $\{y^{ss}, x^{ss}\}$ . By solving a system of linear equations whose co-efficient matrix comprises of these numerical derivatives of the known function  $f$ , the SGU algorithm arrives at the functions  $g(x, \sigma)$  and  $h(x, \sigma)$ . The row of the approximated policy function  $g(x, \sigma)$  that is of paramount interest to us is the one which specifies stochastic-equilibrium portfolio allocations,  $\lambda(x, \sigma)$ , as a function of the state variables, and uncertainty. Further details of this method can be found in Schmitt-Grohé and Uribe (2004).<sup>2</sup>

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<sup>2</sup>A possible issue with this approximation technique is that it ignores the possible heteroscedasticity in the endogenous variables (see Evans and Hnatkovska (2007) for a discussion). In the context of this model, this is less of a problem because the feedback mechanism from asset returns, which

### A.4.3 Algorithm for choosing portfolio approximation point

We search in the neighborhood of a set of points  $(\lambda_{NN}, \lambda_{SS}) \subset [0, 1] \times [0, 1]$  for the “correct” (in a sense that will be defined below) portfolio approximation point. We search among those points that keep (non-stochastic) steady-state wealth distribution constant, and the current account balanced.

**Lemma 6.** *The following locus of portfolios keeps (non-stochastic) steady-state wealth distribution constant, and the current account balanced.*

$$\lambda_{NN}P^{ss} - \lambda_{SS}P^{*ss}e^{ss} = (1 - \alpha)P^{ss} - (1 - \alpha^*)P^{*ss}e^{ss}$$

**Proof:** Recall that the non-stochastic steady-state values of all variables except portfolio shares are determinate. Also they are independent of the value of the portfolio shares, for example, labor incomes in any steady-state are independent of  $\lambda_{NN}$  and  $\lambda_{NS}$ . Thus in any two non-stochastic steady-states  $(\lambda_{NN}, \lambda_{NS}) \in [0, 1] \times [0, 1]$ , denoted by 1 and 2, we must have

$$\lambda_{hh1}D^{ss} + \lambda_{hf1}D^{*ss}e^{ss} = \lambda_{hh2}D^{ss} + \lambda_{hf2}D^{*ss}e^{ss}$$

In particular

$$\lambda_{NN}D^{ss} + \lambda_{NS}D^{*ss}e^{ss} = (1 - \alpha)D^{ss}$$

Using the stock market clearing condition in the North, and the expression for steady-state stock prices, this reduces to the condition in the statement of the lemma. Also note that using the stock market clearing conditions in each country, and the expression for stock steady-state stock prices

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depend on higher order moments of state variables, to the decisions of the firms is weak because of the insider-outsider dichotomy.

$$\lambda_{NN}P^{ss} - \lambda_{SS}P^{*ss}e^{ss} = (1 - \alpha)P^{ss} - (1 - \alpha^*)P^{*ss}e^{ss} \quad (\text{A.79})$$

$$\Rightarrow \lambda_{SN}P^{ss} = \lambda_{NS}P^{*ss}e^{ss} \quad (\text{A.80})$$

which implies that net steady-state transfers are zero. This means the current account is balanced.

#### A.4.4 Algorithm for insider's choice of ownership

We are seeking a maximum of the function that maps insider ownership to expected lifetime utility of the insider.

1. Start with an initial distribution of ownership,  $\alpha^{*}$ .
2. Use the “golden search” algorithm. Choose an interval for  $\alpha$ , say  $[\alpha_{\min}, \alpha_{\max}]$ .
3. Approximate optimal decision rules of economy around steady-state with ownership  $\alpha_{\min}$  and  $\alpha_{\max}$ . Home stock ownership of the Southern insider given by the budget constraint  $\alpha_{SN} = \frac{(\alpha^{*'} - \alpha^*)P_0(\alpha^*)}{P_0(\alpha)}$  for each scenario.
4. Simulate economy with above decision rules around  $\alpha_{\min}$  and  $\alpha_{\max}$ . Calculate average utility of insider in simulations. Update interval according to “golden search” algorithm.
5. Repeat till convergence occurs.

## A.5 Calibration and variables

Table A.8: Notation and calibration

Notation	Explanation
Goods	
$a$	North intermediate good used in North
$b$	South intermediate good used in North
$a^*$	North intermediate good used in South
$b^*$	South intermediate good used in South
$Y_a$	Total North intermediate good produced
$Y_b$	Total South intermediate good produced
Price of goods and services	
$q_a$	North intermediate good price in North
$q_b$	South intermediate good price in North
$q_a^*$	North intermediate good price in South
$q_b^*$	South intermediate good price in South
$W, W^*$	North, South wages
$e$	Real exchange rate
$t$	Terms of trade
Asset market quantities and prices	
$P, P^*$	North, South stock prices
$\alpha, \alpha^*$	Insider ownership in the North, South
$\lambda_{NN}$	North outsider's ownership of Northern asset
$\lambda_{SN}$	South outsider's ownership of Northern asset
$\lambda_{NS}$	North outsider's ownership of Southern asset
$\lambda_{SS}$	South outsider's ownership of Southern asset
Parameters	
$\beta = 0.99$	Discount factor
$\theta = 0.34$	Capital share
$\delta = 0.025$	Depreciation
$\omega = 0.15$	Import share
$Z(t) = 0.91Z(t-1) + \epsilon(t)$	Domestic shocks
$Z^*(t) = 0.91Z^*(t-1) + \epsilon^*(t)$	Foreign shocks
$\sigma_\epsilon^2 = 0.006^2$	Variance of technology shocks

## APPENDIX B

### Appendices for “Fire-Sale FDI or Business as Usual?”

#### B.1 Patterns of MA in Asia during 1990-2008

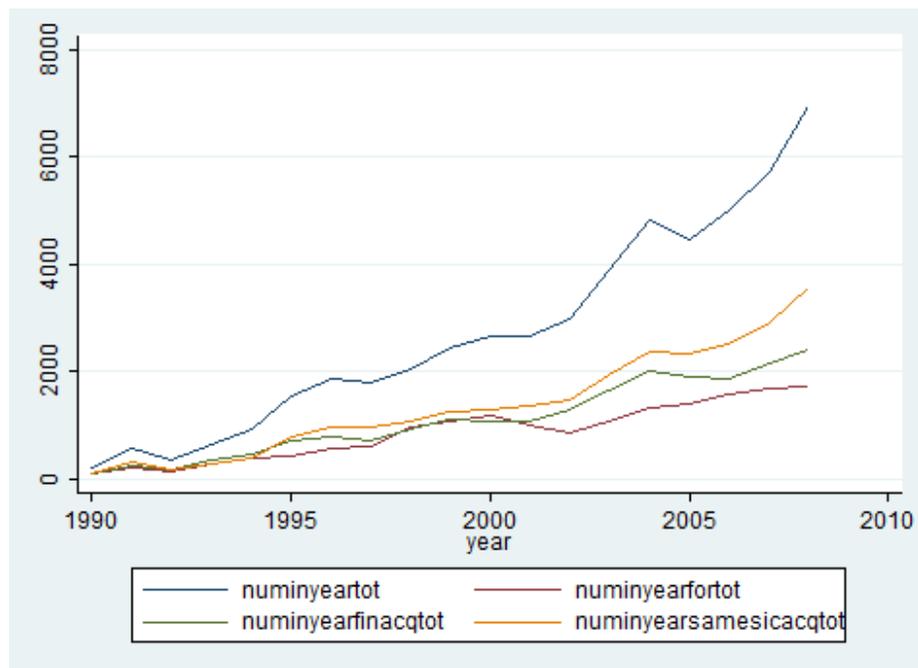


Figure B.1: Total numbers of MA and numbers in three categories

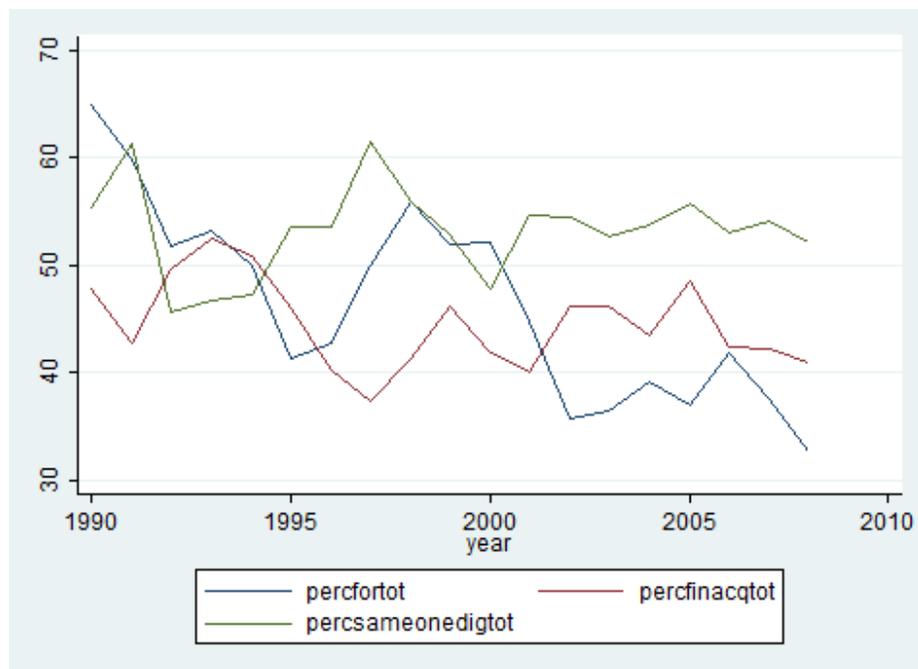


Figure B.2: Percentages of MA in three categories

## B.2 Survival stylized facts

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Country dummy	Coefficient (z-statistic)
China	0.235** (2.48)
South Korea	0.623*** (6.37)
Thailand	0.705*** (7.12)
Vietnam	0.189 (0.98)
Philippines	0.895*** (9.24)
Malaysia	0.366*** (4.02)
Singapore	0.357*** (3.64)
Indonesia	0.598*** (6.07)
India	0.208*** (7.08)
Hong Kong	0.301*** (3.27)

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Table B.1: Cox model with country dummies only (Taiwan baseline hazard)

Controls	Coefficient (z-statistic)
South Korea-Crisis-Foreign	0.423*** (4.85)
South Korea-Crisis-Domestic	0.123** (3.25)
South Korea-No Crisis-Foreign	0.242*** (4.31)
South Korea-No Crisis-Domestic	0.138*** (2.45)
Singapore-Crisis-Foreign	0.298*** (3.03)
Singapore-Crisis-Domestic	0.213*** (3.07)
Singapore-No Crisis-Foreign	0.278*** (4.86)
Singapore-No Crisis-Domestic	0.238*** (3.83)
for. acq.	-1.411*** (-39.15)

Table B.2: Cox model with a complete set of country, crisis, foreign, financial acquiring firm, and same digit SIC dummies and interactions (Taiwan baseline hazard). Selected coefficients reported.

Controls	Coefficient (z-statistic)
foracqdum	-1.093***
acqfindum	0.305***
acqtarsame1digsicdum	0.290***
crisis and high and foracq	0.800***
crisis and high and domacq	0.621***
crisis and high and finacq	-0.238**

Table B.3: Cox model with country, crisis-country, foreign and financial acquiring firm dummies (Taiwan baseline hazard) for subset of acquisitions with 100% stakes

Controls	Coefficient (z-statistic)
South Korea-Crisis-Foreign	0.413*** (4.73)
South Korea-Crisis-Domestic	0.121** (3.15)
South Korea-No Crisis-Foreign	0.272*** (4.21)
South Korea-No Crisis-Domestic	0.188*** (2.72)
Singapore-Crisis-Foreign	0.299*** (3.12)
Singapore-Crisis-Domestic	0.223*** (3.76)
Singapore-No Crisis-Foreign	0.272*** (4.45)
Singapore-No Crisis-Domestic	0.258*** (3.69)
for. acq.	-1.573*** (-37.62)

Table B.4: Cox model with a complete set of country, crisis, foreign, financial acquiring firm, and same digit SIC dummies and interactions (Taiwan baseline hazard, with non-Asian countries included). Selected coefficients reported.

## APPENDIX C

# Appendices for “The Aggregate Consequences of Imperfect Institutions”

### C.1 FSD graphs

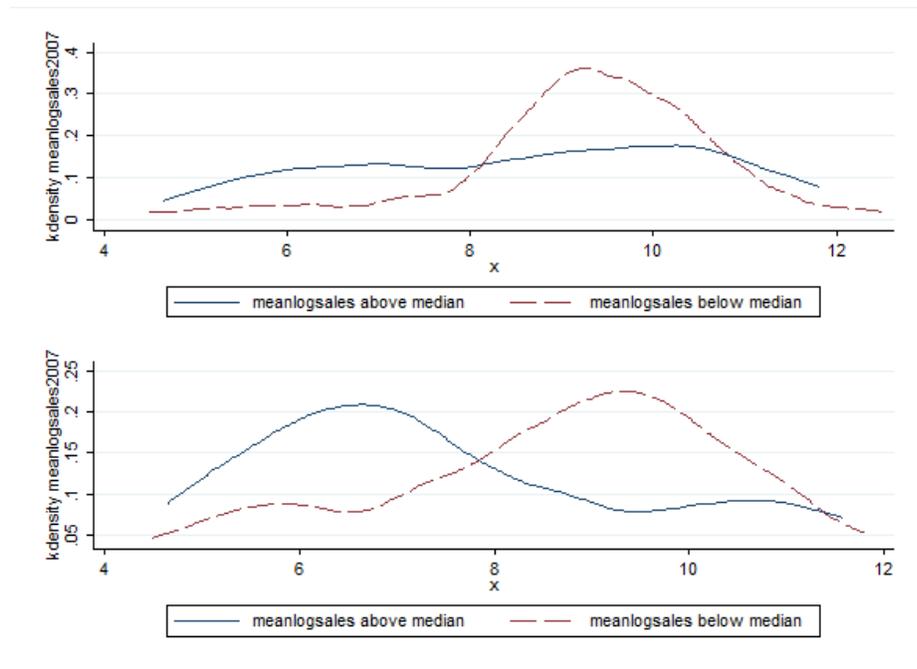


Figure C.1: Firm size distributions using logarithm of 2007 sales. Data source: OR-BIS and Kaufmann et al. (2008)

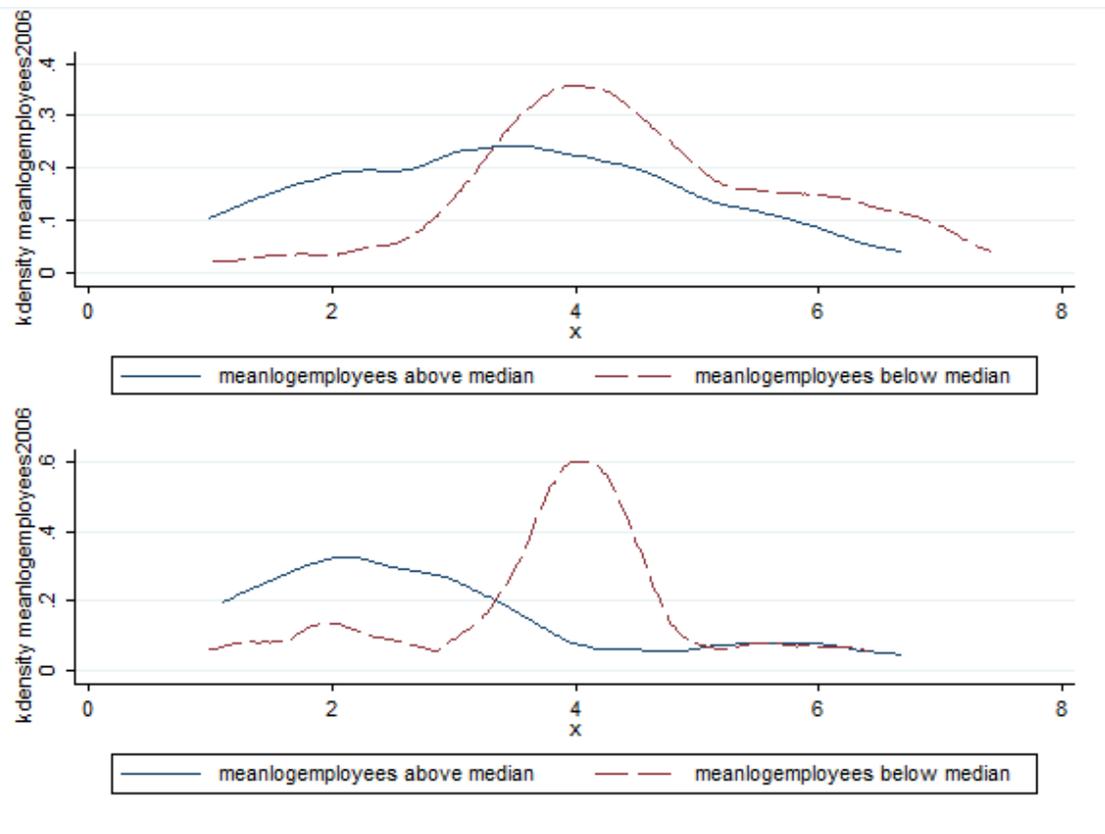


Figure C.2: Firm size distributions using logarithm of 2006 employees. Data source: ORBIS and Kaufmann et al. (2008)

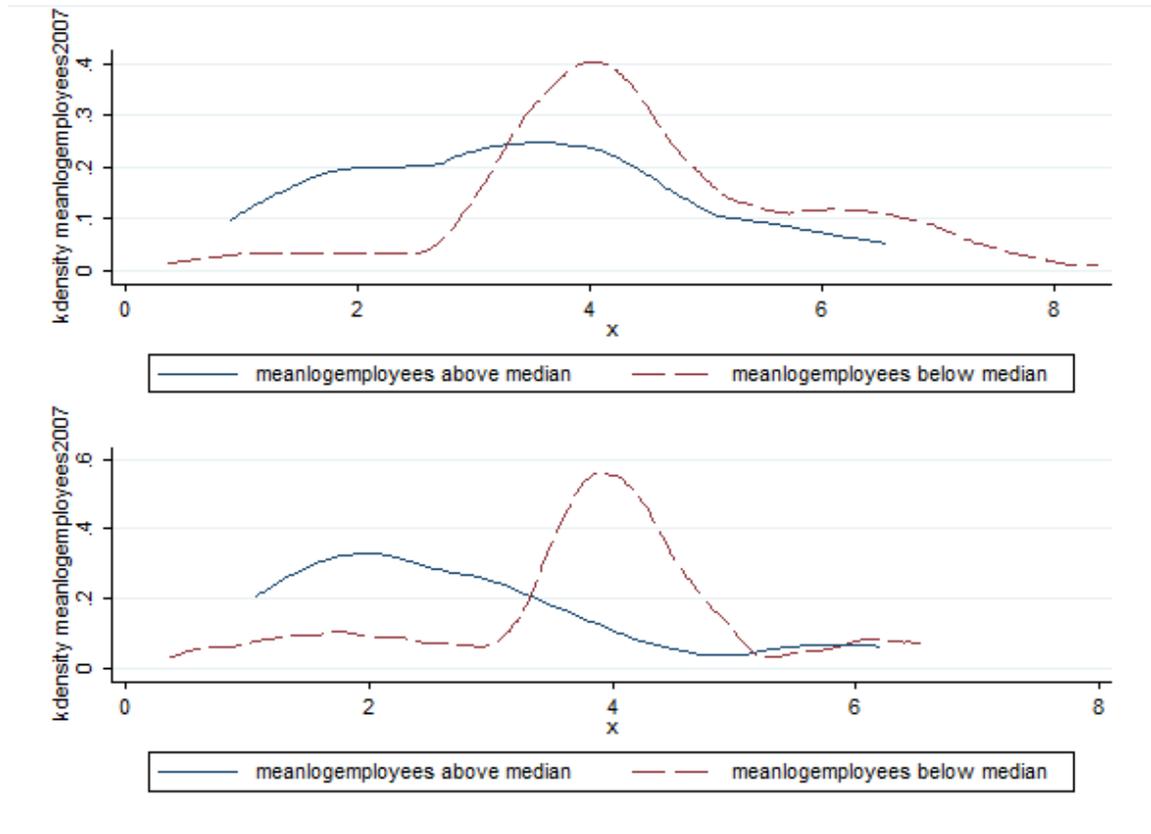


Figure C.3: Firm size distributions using logarithm of 2007 employees. Data source: ORBIS and Kaufmann et al. (2008)

## C.2 Regressions tables

The following tables present point estimates of regression coefficients with robust standard errors. The dependent variables are different in each table. The independent variables are chosen from the following set: institutional quality (*insti*, measured by the index from Kaufmann et al. (2008)), size (*size*, GDP in trillions of USD), level of general development (*devgen*, per capita GDP in thousands of USD), trade openness (*tradeopen*, trade as percentage of GDP), financial development (*devfin*, domestic credit to private sector as percentage of GDP), and financial openness (*finopen*, using the index from Chinn and Ito (2008)).

	(1)	(2)
insti	-0.920*** (-2.71)	-1.615*** (-2.63)
devgen	0.083*** (3.00)	0.097* (1.86)
size	-0.075 (-1.31)	0.146 (1.20)
devfin	-0.014*** (-4.66)	-0.035*** (-5.15)
tradeopen	0.010*** (3.79)	0.024*** (3.65)
finopen	-0.062 (-0.54)	-0.419** (-2.18)
constant	2.129*** (6.56)	3.974*** (5.81)
$R^2$	0.156	0.232
N	168	146

Table C.1: Aggregate volatility: OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1) and (2) are regressions for aggregate volatility measured by standard deviation of GDP and consumption growth rates over the period 2000-2008. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), and WorldBank (2008). Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively. Sample: varying according to availability of data.

	(1)	(2)
insti	-2.843** (-2.04)	-2.444* (-1.84)
devgen	-0.036 (-0.33)	-0.028 (-0.27)
size	-0.465 (-1.07)	-0.267 (-0.68)
tradeopen	0.027** (2.00)	0.051*** (3.37)
finopen	-1.209*** (-2.99)	-1.521*** (-3.60)
constant	10.926*** (7.90)	10.048*** (6.57)
$R^2$	0.162	0.182
N	143	147

Table C.2: Aggregate volatility: OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1) and (2) are regressions for aggregate volatility measured by standard deviation of gross capital formation and gross fixed capital formation growth rates over the period 2000-2008. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008) and WorldBank (2008). Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively. Sample: varying according to availability of data.

	(1)	(2)
insti	15.576* (1.81)	0.291* (1.82)
devgen	1.569 (1.61)	-0.002 (-0.15)
size	0.907 (0.28)	0.583*** (4.42)
constant	34.690*** (5.10)	4.491*** (31.07)
$R^2$	0.325	0.216
N	105	111

Table C.3: Prevalence of market finance: OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1) and (2) are regressions for the prevalence of market finance measured by market capitalization normalized by GDP and the logarithm of the number of listed firms over the period 2000-2008. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD and per capita GDP in thousands of USD. Data sources: Kaufmann et al. (2008) and WorldBank (2008). Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively. Sample: varying according to availability of data.

	(1)	(2)
insti06	-0.687** (-2.42)	
devgen	0.039 (1.43)	
size06	-0.466* (-1.74)	
devfin06	-0.004 (-0.66)	
tradeopen06	0.005* (1.89)	
finopen06	-0.160* (-1.95)	
insti07		-1.006*** (-3.35)
devgen07		0.043 (1.45)
size07		-0.700** (-2.42)
devfin07		0.002 (0.39)
tradeopen07		0.005* (1.70)
finopen07		-0.136 (-1.51)
constant	8.112*** (21.72)	8.117*** (19.98)
$R^2$	0.205	0.212
N	143	137

Table C.4: Mean firm sizes (log sales in 2006 and 2007): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1) and (2) are regressions for country-level mean firm sizes in 2006 and 2007 respectively measured by log sales. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), WorldBank (2008), and ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

	(1)	(2)
insti06	-1.141** (-2.54)	
devgen	0.050 (1.33)	
size06	-0.355 (-1.41)	
devfin06	0.000 (0.05)	
tradeopen06	0.005 (1.49)	
finopen06	0.051 (0.30)	
insti07		-1.377** (-2.62)
devgen07		0.066 (1.66)
size07		-0.504* (-1.91)
devfin07		0.003 (0.44)
tradeopen07		0.006 (1.59)
finopen07		0.000 (0.00)
constant	7.252*** (13.19)	7.167*** (11.94)
$R^2$	0.148	0.159
N	84	74

Table C.5: Mean firm sizes for countries with > 100 observations (log sales in 2006 and 2007): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1) and (2) are regressions for country-level mean firm sizes in 2006 and 2007 respectively measured by log sales. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), WorldBank (2008), and ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
insti06	0.126** (2.11)	0.107* (1.78)	0.073 (0.83)	-0.004 (-0.03)	-0.004 (-0.03)	0.058 (0.45)
size06		0.180*** (2.65)	0.172** (2.42)	0.142* (1.98)	0.142* (1.76)	0.137* (1.70)
devgen06			0.003 (0.62)	0.006 (0.76)	0.006 (0.73)	0.006 (0.60)
devfin06				0.001 (0.98)	0.001 (0.95)	0.001 (0.74)
tradeopen06					-0.000 (-0.01)	0.000 (0.00)
finopen06						-0.058 (-1.36)
constant	-0.102** (-2.00)	-0.135*** (-2.64)	-0.157*** (-2.77)	-0.236*** (-2.95)	-0.235* (-1.89)	-0.176 (-1.17)
$R^2$	0.057	0.136	0.139	0.155	0.155	0.167
N	89	87	87	85	85	84

Table C.6: Skewness of firm sizes for countries with > 100 observations (log sales in 2006): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1), (2), and so forth are regressions for country-level skewness of firm sizes in 2006 measured by log sales adding one independent variable at a time. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), WorldBank (2008), and ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
insti06	0.021 (0.38)	0.018 (0.30)	-0.105 (-1.28)	-0.203** (-2.00)	-0.203* (-1.96)	-0.235* (-1.97)
size06		0.224*** (2.82)	0.186** (2.20)	0.129 (1.57)	0.173* (1.82)	0.157 (1.60)
devgen06			0.012** (2.53)	0.018** (2.22)	0.015 (1.65)	0.017 (1.61)
devfin06				0.001 (1.14)	0.002 (1.33)	0.001 (1.08)
tradeopen06					0.001 (1.09)	0.001 (1.07)
finopen06						0.030 (0.67)
constant	-0.117** (-2.32)	-0.142** (-2.60)	-0.236*** (-3.46)	-0.336*** (-3.67)	-0.463*** (-3.49)	-0.487*** (-3.32)
$R^2$	0.001	0.036	0.063	0.074	0.087	0.093
N	170	160	160	152	146	143

Table C.7: Skewness of firm sizes for countries for entire sample (log sales in 2006): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1), (2), and so forth are regressions for country-level skewness of firm sizes in 2006 measured by log sales adding one independent variable at a time. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), WorldBank (2008), and ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
insti07	0.157** (2.45)	0.139** (2.17)	0.152* (1.74)	0.136 (1.36)	0.135 (1.35)	0.256* (1.93)
size07		0.169** (2.50)	0.172** (2.55)	0.171** (2.32)	0.182** (2.11)	0.169** (2.01)
devgen07			-0.001 (-0.29)	-0.000 (-0.01)	-0.001 (-0.09)	-0.001 (-0.05)
devfin07				-0.000 (-0.03)	-0.000 (-0.03)	-0.000 (-0.24)
tradeopen07					0.000 (0.32)	0.000 (0.37)
finopen07						-0.109* (-1.98)
constant	-0.118* (-1.79)	-0.158** (-2.41)	-0.150** (-2.23)	-0.151 (-1.15)	-0.173 (-1.00)	-0.065 (-0.33)
$R^2$	0.072	0.137	0.138	0.132	0.133	0.183
N	81	79	79	75	75	74

Table C.8: Skewness of firm sizes for countries with > 100 observations (log sales in 2007): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1), (2), and so forth are regressions for country-level skewness of firm sizes in 2007 measured by log sales adding one independent variable at a time. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), WorldBank (2008), and ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
insti07	0.132*** (2.77)	0.108** (2.03)	0.031 (0.41)	0.036 (0.39)	-0.010 (-0.11)	-0.031 (-0.28)
size07		0.227*** (2.74)	0.204** (2.35)	0.219** (2.16)	0.242** (2.15)	0.237* (1.96)
devgen07			0.007* (1.77)	0.011 (1.53)	0.011 (1.33)	0.013 (1.22)
devfin07				-0.001 (-0.91)	-0.001 (-0.76)	-0.001 (-0.72)
tradeopen07					0.001 (0.93)	0.001 (0.92)
finopen07						-0.006 (-0.16)
constant	-0.214*** (-4.74)	-0.242*** (-4.91)	-0.300*** (-4.89)	-0.251** (-2.57)	-0.327** (-2.50)	-0.345** (-2.41)
$R^2$	0.041	0.085	0.097	0.092	0.097	0.098
N	169	158	158	148	139	136

Table C.9: Skewness of firm sizes for countries for entire sample (log sales in 2007): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (1), (2), and so forth are regressions for country-level skewness of firm sizes in 2007 measured by log sales adding one independent variable at a time. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), WorldBank (2008), and ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

One-digit SIC	(0)	(1)	(2)	(3)	(4)
insti06	-1.190* (-1.97)	-2.166*** (-4.53)	-1.055*** (-2.72)	-0.895** (-2.07)	-1.109** (-2.32)
devgen06	0.024 (0.54)	0.113*** (2.95)	0.051* (1.71)	0.078** (2.48)	0.039 (1.02)
size06	-0.166 (-0.59)	-0.766*** (-2.96)	-0.374 (-1.64)	-0.440** (-2.13)	-0.469 (-1.59)
devfin06	-0.000 (-0.05)	0.001 (0.20)	-0.001 (-0.15)	-0.004 (-0.68)	-0.000 (-0.04)
tradeopen06	0.004 (0.73)	0.006* (1.71)	0.005 (1.64)	0.004 (1.21)	0.007* (1.71)
finopen06	-0.036 (-0.16)	-0.173 (-1.04)	-0.070 (-0.52)	-0.127 (-1.02)	0.037 (0.22)
constant	7.873*** (9.94)	7.732*** (15.20)	8.273*** (18.00)	8.327*** (18.16)	8.387*** (15.43)
$R^2$	0.167	0.310	0.152	0.132	0.127
N	89.000	107.000	119.000	110.000	118.000

Table C.10: Mean firm sizes for countries for entire sample (log sales in 2006): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (0), (1), and so forth are regressions for country level skewness of firm sizes measured by log sales in 2006 for one-digit SIC (0), (1), and so forth. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), WorldBank (2008), and ORBIS. Coefficients marked \* \* \*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

One-digit SIC	(5)	(6)	(7)	(8)	(9)
insti06	-0.313 (-0.91)	-0.926** (-2.50)	-0.993** (-2.29)	-1.100** (-2.07)	0.428 (0.39)
devgen	0.035 (1.19)	0.045 (1.18)	0.074** (2.27)	0.058 (1.40)	0.005 (0.07)
size06	-0.170 (-0.59)	-0.505 (-1.36)	-0.366 (-1.46)	-0.239 (-0.63)	-0.079 (-0.18)
devfin06	-0.001 (-0.23)	-0.002 (-0.34)	-0.002 (-0.38)	0.001 (0.12)	0.000 (0.02)
tradeopen06	0.006* (1.89)	0.003 (1.07)	0.005 (1.51)	0.006 (1.42)	-0.000 (-0.08)
finopen06	-0.240** (-2.41)	-0.137 (-1.40)	-0.105 (-0.72)	-0.067 (-0.34)	-0.586 (-1.64)
constant	7.682*** (17.13)	8.298*** (18.34)	6.989*** (14.24)	6.764*** (11.12)	8.743*** (8.32)
$R^2$	0.089	0.165	0.133	0.091	0.067
N	129.000	140.000	101.000	91.000	51.000

Table C.11: Mean firm sizes for countries for entire sample (log sales in 2006): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Columns labeled (5), (6), and so forth are regressions for country level skewness of firm sizes measured by log sales in 2006 for one-digit SIC (5), (6), and so forth. Independent variables are the institutional quality index from Kaufmann et al. (2008), GDP in trillions of USD, per capita GDP in thousands of USD, trade as percentage of GDP, domestic credit to private sector as percentage of GDP, and the financial openness index of Chinn and Ito (2008). Data sources: Kaufmann et al. (2008), Chinn and Ito (2008), WorldBank (2008), and ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

Country	$b_i$	$R^2$
Argentina	-1.162***	0.988
Australia	-0.894***	0.971
Austria	-0.637***	0.943
Belgium	-0.907***	0.994
Bosnia and Herzegovina	-1.033***	0.993
Brazil	-0.743***	0.976
Bulgaria	-0.906***	0.984
Canada	-0.863***	0.999
China	-0.799***	0.983
Croatia	-0.865***	0.990
Czech Republic	-0.811***	0.989
Denmark	-0.459***	0.977
Estonia	-0.958***	0.993
Finland	-0.745***	1.00
France	-0.825***	0.999
Germany	-0.507***	0.988
Greece	-0.845**	0.992
Hungary	-0.904***	0.998
India	-0.432***	0.946
Ireland	-0.417***	0.940
Italy	-0.866***	0.995
Japan	-0.779***	0.997

Table C.12: Pareto coefficients at country level (log sales in 2006) using OLS regressions (Argentina to Japan). This table presents point estimates of Pareto coefficients using the method in Gabaix and Ibragimov (2009), rounded to three significant digits, and the  $R^2$  of each regression. Sample of 44 countries are those used in di Giovanni and Levchenko (2009). Estimation procedure is described in the text. Data sources: ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

Country	$b_i$	$R^2$
Latvia	-0.888***	0.974
Lithuania	-0.898***	0.984
Macedonia	-0.770***	0.978
Netherlands	-0.328***	0.888
Norway	-0.801***	0.997
Poland	-0.770***	0.982
Portugal	-0.924***	1.000
Korea, Republic of	-0.791***	0.989
Romania	-0.993***	0.997
Russia	-0.824***	0.993
Serbia	-1.002***	0.997
Singapore	-0.350***	0.922
Slovakia	-0.838***	0.988
Slovenia	-0.771***	0.987
Spain	-0.924***	0.998
Sweden	-0.787***	0.997
Switzerland	-0.434***	0.934
Taiwan POC	-0.300***	0.869
Thailand	-0.638***	0.990
Ukraine	-0.882***	0.995
United Kingdom	-0.488***	0.973

Table C.13: Pareto coefficients at country level (log sales in 2006) using OLS regressions (Latvia to United Kingdom). This table presents point estimates of Pareto coefficients using the method in Gabaix and Ibragimov (2009), rounded to three significant digits, and the  $R^2$  of each regression. Sample of 44 countries are those used in di Giovanni and Levchenko (2009). Estimation procedure is described in the text. Data sources: ORBIS. Coefficients marked \*\*\*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

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Institutions	0.109*** (2.71)
constant	-0.838*** (-18.72)
$R^2$	0.156
N	41

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Table C.14: Pareto coefficients versus institutions (log sales in 2006): OLS regression coefficients with heteroscedasticity-robust standard errors. This table presents point estimates of regression coefficients with heteroscedasticity-robust standard errors in brackets, rounded to three significant digits. Independent variable is the institutional quality index from Kaufmann et al. (2008). Data sources: Kaufmann et al. (2008) and ORBIS. Coefficients marked \* \* \*, \*\*, and \* are significant at 1%, 5%, and 10% respectively.

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